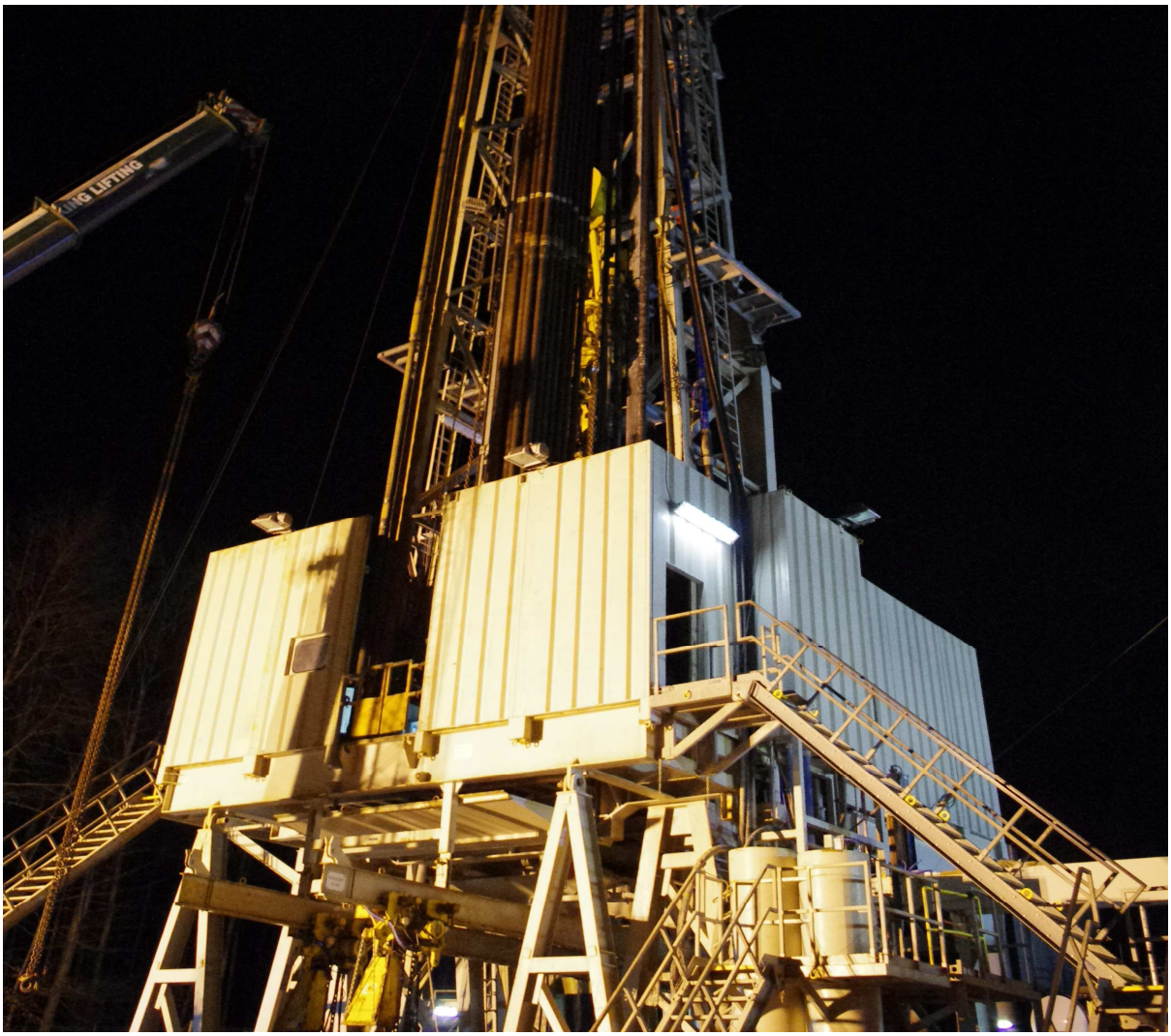


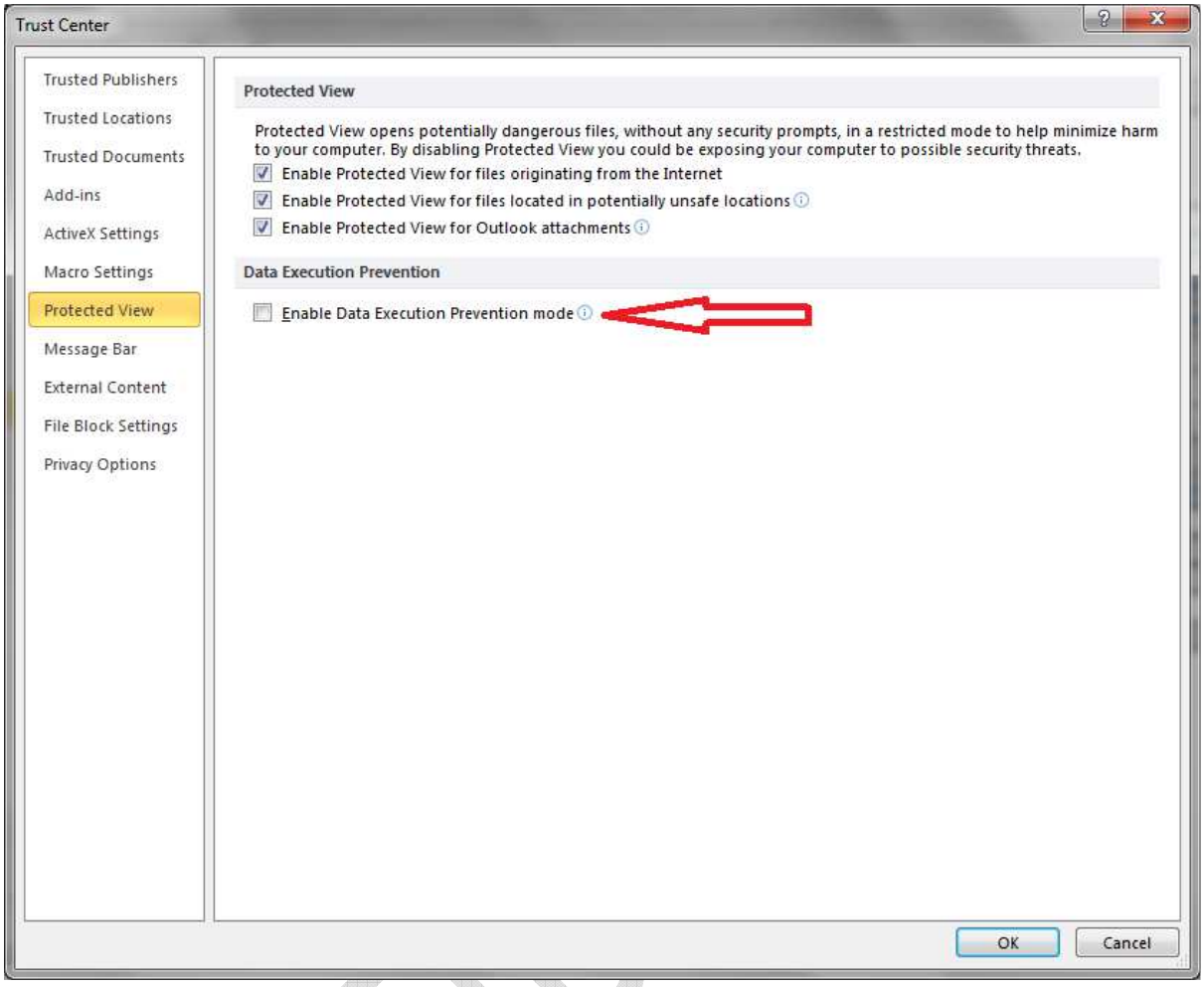
INNOVA
Drilling & Intervention

IDI – TAD Calc

INSTRUCTION MANUAL

Rev 1.1

Contents



Innova Drilling & Intervention

Union Plaza (6th Floor)

1 Union Wynd

Aberdeen

Scotland

AB10 1DQ

System requirements

1 gigahertz (GHz) or faster 32-bit (x86) or 64-bit (x64) processor

1 GB of RAM

15MB of hard disk space

Microsoft Excel 2007 or later

Microsoft Windows XP, Vista or 7

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1.0 - Software Overview

The IDI – TAD Calc program has been written to provide a practical and easy to use solution for the computation of drill string torque and drag. The program is based around a complied macro enabled Excel workbook. This enables any user familiar with Excel operation to use the program. Calculations are performed using the latest soft string models with multiple friction factors analysed with each calculation. The main features of the program are:

- Simple operation based around an Excel spreadsheet
- Latest soft string model
- Calculate T&D for tripping and on bottom
- Calculate T&D while reaming
- Calculate sinusoidal and helical buckling limits
- Calculations for casing, liner & drilling assemblies
- Friction factor sensitivity analysis
- Models casing flotation / drill string fill
- Friction reduction devices can be included into calculation
- Calculates expected pipe stretch and torque induced pipe twist
- Elemental (snapshot) view available for all calculations
- Creates fully customisable charts for all data
- Model can be updated with actual mud data and well bore trajectory in order to facilitate accurate computation
- Charts can be annotated with comments and model information
- SI and Imperial units fully supported
- Real time data can be displayed alongside the calculated data

2.0 – Getting Started

2.1 – Program Installation

The IDI – TAD Calc Program comes as an installable .msi file. Once the installation file has been downloaded the program can be installed onto any computer with Microsoft Excel 2007 or later installed. Running the installation program brings up the following dialog.

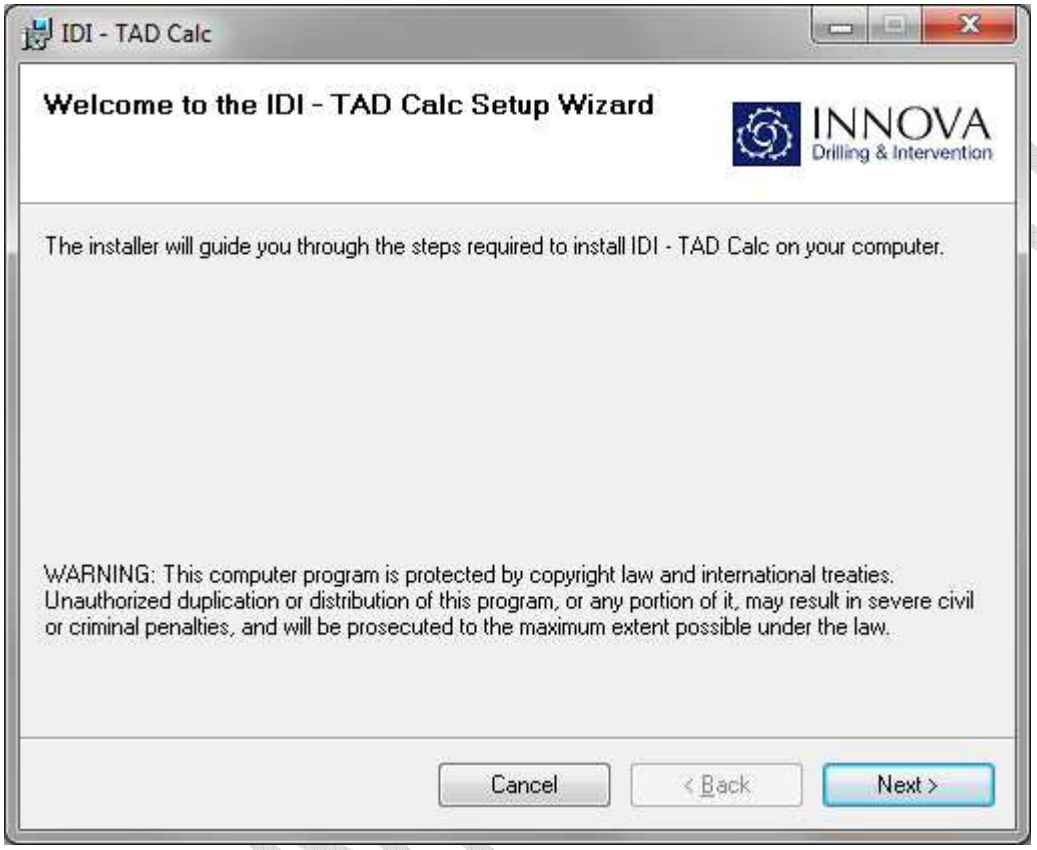


Figure 1

Click on the “Next” button to move to the following window

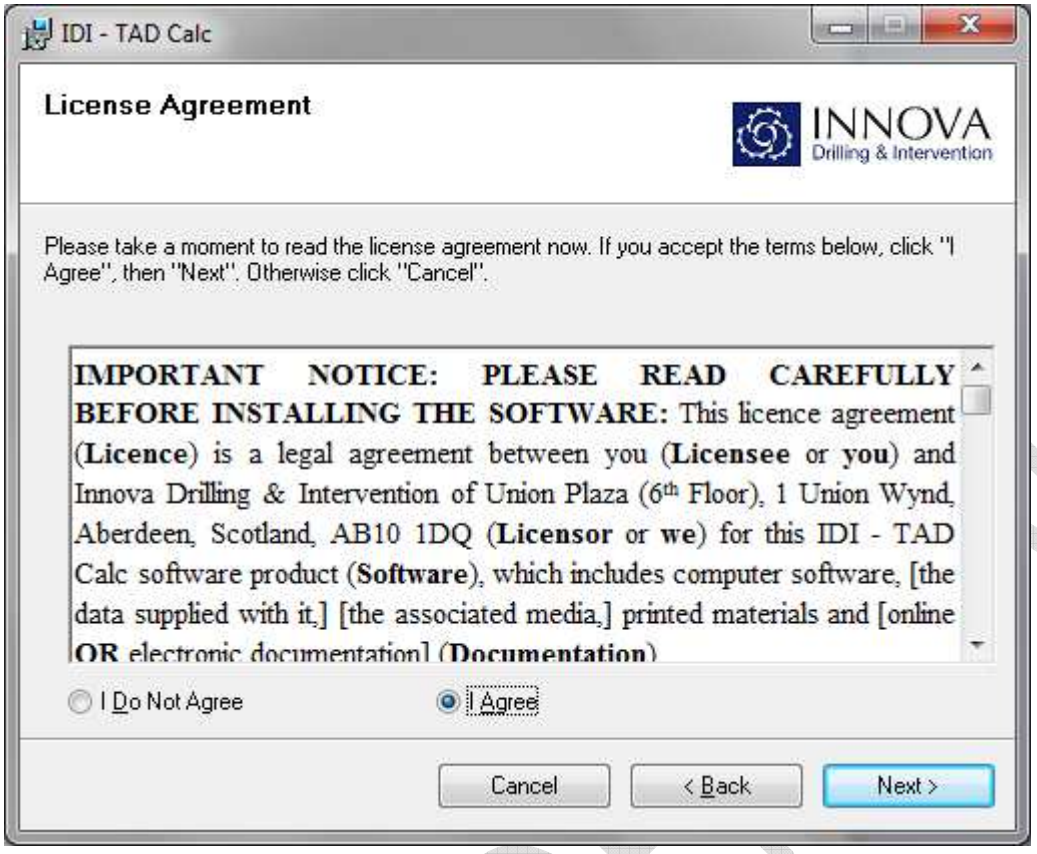


Figure 2

In order to continue, the user must click on the “I Agree” radio button to accept the end user licence agreement. Once this is done click on the “Next” Button.

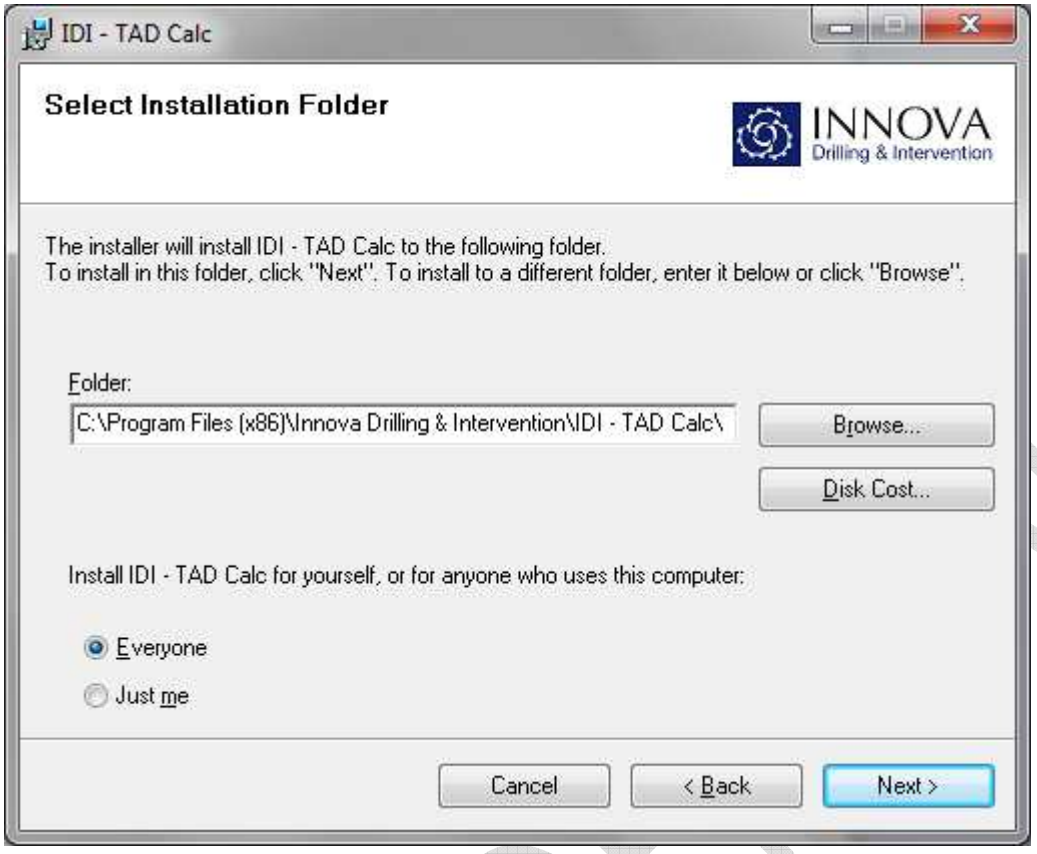


Figure 3

Select the destination folder on the target computer where the program is to be installed and click on the “Next” button. To install for one user, ensure the “Just Me” radio button is selected; to install for all users, click on “Everyone”.

The program will now be installed and a folder placed in the users start menu.

2.2 – Program Operation

To use the program, click on either the start menu or desktop shortcut. Until the program is registered, a dialog message will be displayed on each opening of the program. On first use, the user must accept the software end user licence agreement. The program can now be run as per this manual.

The program uses the Microsoft Excel interface; data entry, printing and saving are as per standard Excel use. The original program cannot be overwritten. If data is to be saved it must be done as a TAD Calc project file, as explained later in this manual.

3.0 – Program Operation

3.1 – Main Page

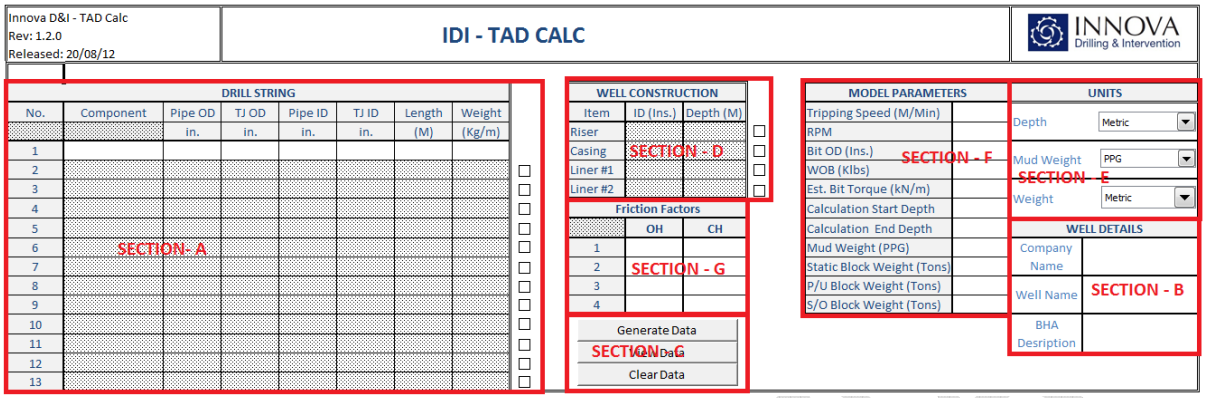


Figure 4

When IDI – TAD Calc is initialized the main page (shown in fig 4.) will be displayed. This page is the main data entry page for all TAD – Calc functions.

Section A: Drill string details are entered in to this section. The drill string is divided into sections depending on the OD / ID. It is up to the user to define how the drill string is broken down and entered. The program accommodates 13 drill string components all of which are activated by clicking the adjacent checkbox.

If a component has missing details, an error will be flagged. The length of the final drill string component is calculated automatically based on the TD entered in Section A and the cumulative length of the other drill string components.

The drill string components must have an OD that allows them to pass through the ID of the casing / liner if present and the open hole. If this is not the case, an error will be displayed during the calculation.

Section B: This section allows details about the well and run to be entered. This information will be used for the chart headings.

Section C: This section contains the control buttons for the sheet. If the "Generate Data" button is pressed the following dialog window will be displayed.

Figure 5

This dialog will allow the user to perform a T&D calculation. Pressing the "Drilling Data" button calculates the drilling hookloads, on / off bottom torques, pipe twist / stretch, reaming hookloads and torques. The "Snapshot Data" button calculates elemental data for a single depth. When the button is pressed a prompt (fig 6.) will appear requesting the depth to be calculated. Once this is done, tension plots and snapshot charts will be available for viewing. The snapshot view also enables the side forces chart.

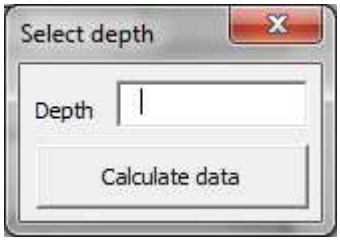


Figure 6

The "View Data" button shown in section C will allow the user to view all generated data and charts as well as loading TAD Calc projects. This is covered in detail in section 3.2.

The "Clear Data" button clears the sheet of all data.

Section D: The wellbore construction can be setup in this section. To activate a component, click on the check box next to it. Enter the ID and the depth of the bottom of the section. For casing this is either the shoe depth or the top of the liner lap. Liner #2 cannot be activated without liner #1, and likewise liner #1 cannot be activated without casing. The riser can be activated either on its own or with casing. Click the update button to save and close the form.

Section E: This section allows the units for the sheet to be specified. This should be done before performing a calculation. It should be noted that if the units are changed, the values entered and the calculated results do not change unless the calculation is redone.

Section F: This section allows data for the calculation to be entered, this is detailed below:

- **Tripping Speed:** This is the speed at which the string is moved axially (up / down) within the well bore. This can be specified in either feet or meters per minute. This value is used for calculating hookloads and torques while reaming.
- **RPM:** The rotational speed of the drill string, this is to be specified in revolutions per minute. This value is used for calculating hookloads and torques while reaming.
- **Mud Weight:** This is the mud weight entered in either PPG or S.G. This is data used for calculating the buoyancy factor for the drill string.
- **Calculation Start Depth:** The depth of the first calculation
- **Calculation End Depth:** The depth of the final calculation
- **Bit OD:** The OD of the drill bit / shoe in inches. This figure is used to calculated the estimated bit torque
- **WOB:** The average weight on bit while drilling / reaming. This value is used to calculate the estimated bit torque as well as being used for on-bottom tension and torque calculations.
- **Est. Bit Torque:** Calculated from the bit OD and WOB. This figure is used for calculating on bottom torques.
- **Static Block Weight:** The weight of the travelling assembly while stationary.
- **P/U Block Weight:** The weight of the travelling assembly while picking up.
- **S/O Block Weight:** The weight of the travelling assembly while slacking off.

Section G: Open hole and cased hole friction factors can be entered here. Four different combinations of friction factor can be entered.

3.2 – View Data

When the "View Data" button in section C of fig 5. The dialog shown in fig. 7 will be shown. This window allows access to all charts and calculated data generated. It also allows projects to be saved / opened and surveys to be entered.

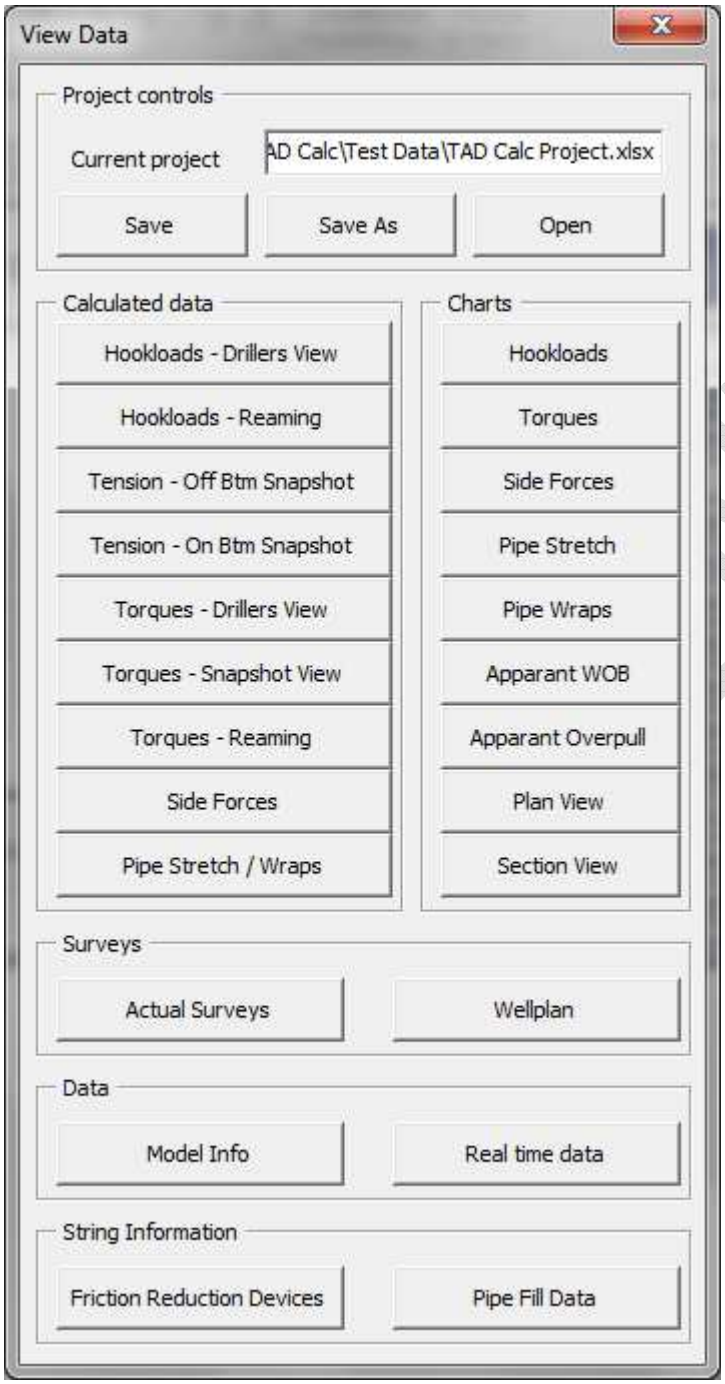


Figure 7

3.2.1 – Project Controls

The project controls are located at the top of the "View Data" window. The TAD Calc program cannot be overwritten, data is saved as a TAD Calc project file. To save a project, click on the "Save" button and a standard Excel "Save As" dialog box will appear. Select the location for the project file and click on the "Save" button. TAD Calc project files are Excel workbooks in a specific file format. If a project is already open the project will be saved as the current project. To save as a new project, click the "Save As" button. To open a project, click on the "Open Project" button and select the required project file. If the file selected is not a TAD Calc project file, an error will be displayed.

3.2.2 – Calculated Data

The calculated data section allows access to all the numerical values generated in the calculation process.

3.2.2.1 – Hookloads – Driller's View

The Driller's View hookloads are the hookloads the driller will see at a given depth while rotating on bottom, picking up and slacking off. To return to the main page click on the "home" icon at the top right hand side of the page.

CALCULATED DRILLING HOOKLOAD DATA

		FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	ROT (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)
100	95.34	95.34	95.34	95.34	95.34	95.34	95.34	95.34	95.34
200	103.83	103.83	103.83	103.83	103.83	103.83	103.83	103.83	103.83
300	108.45	108.46	108.45	108.46	108.45	108.46	108.45	108.46	108.45
400	112.80	112.83	112.77	112.83	112.77	112.83	112.77	112.83	112.77
500	115.76	115.83	115.68	115.83	115.68	115.83	115.68	115.83	115.68
600	118.24	118.36	118.12	118.36	118.12	118.36	118.12	118.36	118.12
700	120.43	120.60	120.26	120.60	120.26	120.60	120.26	120.60	120.26
800	122.44	122.67	122.22	122.67	122.22	122.67	122.22	122.67	122.22
900	120.81	121.09	120.53	121.09	120.53	121.09	120.53	121.09	120.53
1000	122.50	122.84	122.17	122.84	122.17	122.84	122.17	122.84	122.17
1100	122.68	123.06	122.31	123.06	122.31	123.06	122.31	123.06	122.31
1200	124.54	124.95	124.13	124.95	124.13	124.95	124.13	124.95	124.13
1300	127.20	127.72	126.68	127.72	126.68	127.72	126.68	127.72	126.68
1400	130.06	130.77	129.36	130.77	129.36	130.77	129.36	130.77	129.36
1500	130.71	131.68	129.76	131.69	129.74	131.71	129.73	131.73	129.71
1600	133.92	135.45	132.43	135.51	132.38	135.56	132.33	135.62	132.28
1700	137.24	139.34	135.20	139.42	135.12	139.51	135.05	139.59	134.97
1800	140.65	143.42	137.97	143.53	137.87	143.65	137.76	143.76	137.66

Figure 8

3.2.2.2 – Hookloads – Reaming

The reaming hookloads are the hookloads the driller will see at a given depth while reaming up and down. To return to the main page click on the "home" icon at the top right hand side of the page.

CALCULATED REAMING HOOKLOAD DATA

		FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	ROT (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)
100	95.34	99.91	99.79	99.91	99.79	99.91	99.79	99.91	99.79
200	103.83	107.58	107.38	107.58	107.38	107.58	107.38	107.58	107.38
300	108.45	111.37	111.11	111.37	111.11	111.37	111.11	111.37	111.11
400	112.80	114.89	114.56	114.89	114.56	114.89	114.56	114.89	114.56
500	115.76	117.01	116.61	117.01	116.61	117.01	116.61	117.01	116.61
600	118.24	119.45	118.96	119.45	118.96	119.45	118.96	119.45	118.96
700	120.43	121.59	120.99	121.59	120.99	121.59	120.99	121.59	120.99
800	122.44	123.62	122.89	123.62	122.89	123.62	122.89	123.62	122.89
900	120.81	122.07	121.18	122.07	121.18	122.07	121.18	122.07	121.18
1000	122.50	123.89	122.75	123.89	122.75	123.89	122.75	123.89	122.75
1100	122.68	124.22	122.79	124.22	122.79	124.22	122.79	124.22	122.79
1200	124.54	126.32	124.41	126.32	124.41	126.32	124.41	126.32	124.41
1300	127.20	129.28	126.77	129.28	126.77	129.29	126.77	129.29	126.76
1400	130.06	132.49	129.30	132.49	129.29	132.50	129.29	132.51	129.28
1500	130.71	135.88	131.87	135.90	131.85	135.92	131.83	135.95	131.81
1600	133.92	145.71	140.22	145.77	140.16	145.84	140.10	145.90	140.04

Figure 9

3.2.2.3 –Tension – Off Btm Snapshot

The tension off bottom snapshot shows the elemental tensions build-up of tension within the drill string at a single depth while off bottom. The depth at which the data is generated is displayed in the page heading. To return to the main page click on the "home" icon at the top right hand side of the page.

SNAPSHOT TRIPPING TENSION DATA @ 5000ft

		FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	ROT (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)
0.00	141.25	166.91	122.20	171.85	119.67	177.04	117.27	182.51	114.98
22.00	107.25	132.91	88.20	137.85	85.67	143.04	83.27	148.51	80.98
176.00	106.89	132.56	87.85	137.49	85.32	142.68	82.91	148.15	80.63
236.00	104.40	129.97	85.41	134.90	82.88	140.09	80.47	145.56	78.19
286.00	103.43	128.98	84.45	133.91	81.92	139.10	79.51	144.57	77.22
331.00	102.62	128.00	83.75	132.92	81.22	138.11	78.81	143.57	76.52
420.00	101.89	127.11	83.13	132.03	80.59	137.20	78.18	142.65	75.89
515.00	100.45	125.63	81.71	130.54	79.17	135.72	76.76	141.17	74.47
611.00	98.91	124.08	80.18	128.99	77.64	134.17	75.23	139.62	72.94
705.00	97.35	122.48	78.66	127.39	76.12	132.56	73.70	138.01	71.41
799.00	95.83	120.91	77.16	125.82	74.62	130.99	72.20	136.44	69.91
901.00	94.31	119.35	75.66	124.26	73.12	129.43	70.71	134.87	68.41
1041.00	92.65	117.65	74.04	122.56	71.50	127.73	69.08	133.17	66.78
1135.00	90.39	115.37	71.78	120.27	69.24	125.44	66.82	130.88	64.52
1229.00	88.86	113.14	70.70	118.01	68.14	123.15	65.71	128.55	63.40
1322.00	87.34	110.93	69.61	115.77	67.03	120.88	64.59	126.25	62.26
1417.00	85.84	109.05	68.34	113.88	65.76	118.97	63.30	124.32	60.97
1511.00	84.32	106.99	67.15	111.79	64.55	116.85	62.08	122.18	59.74

Figure 10

3.2.2.4 – Tension – On Btm Snapshot

The tension off bottom snapshot shows the elemental tensions build-up of tension within the drill string at a single depth while on bottom. The depth at which the data is generated is displayed in the page heading. To return to the main page click on the "home" icon at the top right hand side of the page.

SNAPSHOT ON BOTTOM TENSION DATA @ 5000ft

		FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	ROT (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)
0.00	126.25	166.91	111.30	171.85	109.34	177.04	107.48	182.51	105.70
22.00	92.25	132.91	77.30	137.85	75.34	143.04	73.48	148.51	71.70
176.00	91.89	132.56	76.95	137.49	74.98	142.68	73.12	148.15	71.35
236.00	89.40	129.97	74.50	134.90	72.54	140.09	70.67	145.56	68.90
286.00	88.43	128.98	73.54	133.91	71.58	139.10	69.71	144.57	67.94
331.00	87.62	128.00	72.83	132.92	70.86	138.11	68.99	143.57	67.22
420.00	86.89	127.11	72.19	132.03	70.22	137.20	68.35	142.65	66.57
515.00	85.45	125.63	70.77	130.54	68.80	135.72	66.93	141.17	65.15
611.00	83.91	124.08	69.24	128.99	67.27	134.17	65.40	139.62	63.62
705.00	82.35	122.48	67.71	127.39	65.74	132.56	63.87	138.01	62.09
799.00	80.83	120.91	66.21	125.82	64.24	130.99	62.37	136.44	60.58
901.00	79.31	119.35	64.71	124.26	62.74	129.43	60.87	134.87	59.08
1041.00	77.65	117.65	63.08	122.56	61.11	127.73	59.24	133.17	57.45
1135.00	75.39	115.37	60.82	120.27	58.85	125.44	56.97	130.88	55.19
1229.00	73.86	113.14	59.67	118.01	57.69	123.15	55.80	128.55	54.01
1322.00	72.34	110.93	58.51	115.77	56.52	120.88	54.62	126.25	52.81
1417.00	70.84	109.05	57.21	113.88	55.20	118.97	53.30	124.32	51.49
1511.00	69.32	106.99	55.96	111.79	53.95	116.85	52.03	122.18	50.21

Figure 11

3.2.2.5 – Torque – Driller's View

The Driller's View torques are the torques the driller will see at a given depth while rotating on bottom and off bottom. To return to the main page click on the "home" icon at the top right hand side of the page.

CALCULATED TORQUE DATA

	FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)
100	0.08	2.86	0.08	2.86	0.08	2.86	0.08	2.86
200	-0.06	2.82	-0.10	2.81	-0.13	2.79	-0.17	2.78
300	-0.03	2.84	-0.07	2.83	-0.11	2.81	-0.14	2.80
400	0.00	2.86	-0.04	2.85	-0.07	2.83	-0.11	2.82
500	0.02	2.88	-0.02	2.87	-0.06	2.85	-0.10	2.84
600	0.07	2.92	0.02	2.90	-0.02	2.88	-0.06	2.87
700	0.14	2.97	0.09	2.95	0.05	2.93	0.01	2.91
800	0.23	3.03	0.19	3.02	0.15	3.00	0.10	2.98
900	0.53	3.19	0.52	3.19	0.51	3.18	0.51	3.18
1000	0.68	3.30	0.67	3.29	0.66	3.29	0.66	3.29
1100	0.86	3.42	0.85	3.41	0.84	3.41	0.83	3.41
1200	1.11	3.62	1.10	3.61	1.09	3.61	1.09	3.61
1300	1.42	3.86	1.42	3.86	1.42	3.87	1.42	3.87
1400	1.74	4.13	1.75	4.13	1.77	4.14	1.78	4.15
1500	2.02	4.36	2.06	4.39	2.10	4.41	2.13	4.44
1600	2.50	4.78	2.60	4.85	2.69	4.92	2.78	4.99
1700	2.99	5.18	3.14	5.30	3.29	5.41	3.44	5.53
1800	3.52	5.62	3.74	5.79	3.96	5.97	4.19	6.14

Figure 12

3.2.2.6 – Torques - Snapshot View

The snapshot torque shows the elemental tensions build-up of torque within the drill string at a single depth while off bottom. The depth at which the data is generated is displayed in the page heading. To return to the main page click on the “home” icon at the top right hand side of the page.

SNAPSHOT TORQUE DATA @ 5000ft

	FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)	On Bottom (kft/lbs)	Off Bottom (kft/lbs)
0.00	14.36	15.26	16.27	17.82	18.18	20.38	20.09	22.94
22.00	14.36	15.26	16.27	17.82	18.18	20.38	20.09	22.94
176.00	14.36	15.26	16.27	17.82	18.18	20.38	20.09	22.94
236.00	14.33	15.21	16.24	17.78	18.14	20.34	20.05	22.90
286.00	14.32	15.21	16.23	17.77	18.14	20.33	20.05	22.89
331.00	14.26	15.13	16.17	17.69	18.07	20.25	19.98	22.82
420.00	14.20	15.06	16.10	17.62	18.01	20.18	19.92	22.74
515.00	14.18	15.04	16.09	17.60	18.00	20.17	19.91	22.73
611.00	14.18	15.04	16.08	17.60	17.99	20.16	19.90	22.72
705.00	14.16	15.01	16.07	17.58	17.97	20.14	19.88	22.70
799.00	14.14	15.00	16.05	17.56	17.96	20.12	19.87	22.68
901.00	14.13	14.98	16.04	17.54	17.94	20.10	19.85	22.66
1041.00	14.11	14.96	16.02	17.52	17.93	20.08	19.84	22.64
1135.00	14.11	14.95	16.01	17.51	17.92	20.08	19.83	22.64
1229.00	13.85	14.64	15.75	17.20	17.66	19.76	19.57	22.33
1322.00	13.59	14.34	15.50	16.90	17.41	19.46	19.32	22.02
1417.00	13.46	14.17	15.36	16.73	17.27	19.29	19.18	21.86
1511.00	13.26	13.93	15.17	16.50	17.08	19.06	18.98	21.62

Figure 13

3.2.2.7 – Torques - Reaming

The reaming torque shows the torques within the drill string which the driller will see while picking up and slacking off. To return to the main page click on the “home” icon at the top right hand side of the page.

CALCULATED REAMING TORQUE DATA

	FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	PU (Kft/lbs)	SO (Kft/lbs)	PU (Kft/lbs)	SO (Kft/lbs)	PU (Kft/lbs)	SO (Kft/lbs)	PU (Kft/lbs)	SO (Kft/lbs)
100	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
200	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
300	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
400	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
500	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
600	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
700	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
800	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
900	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
1000	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
1100	0.53	0.52	0.53	0.52	0.53	0.52	0.53	0.52
1200	0.70	0.69	0.70	0.69	0.70	0.69	0.70	0.69
1300	0.91	0.90	0.92	0.90	0.92	0.91	0.92	0.91
1400	1.14	1.12	1.15	1.13	1.16	1.14	1.16	1.14
1500	1.42	1.39	1.45	1.42	1.48	1.45	1.51	1.47
1600	1.94	1.89	2.02	1.96	2.09	2.03	2.17	2.10
1700	2.38	2.31	2.50	2.43	2.62	2.54	2.74	2.65
1800	2.86	2.77	3.03	2.93	3.20	3.09	3.37	3.25

Figure 14

3.2.2.8 – Side Forces

The Side Forces shows the normal contact (side forces) generated within the drill string at a single depth while rotating, picking up and slacking off. The side forces are only available if snapshot data has been generated. To return to the main page, click on the "home" button at the top right hand side of the screen.

SIDE FORCES @ 5000ft

		FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	ROT (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)	P/U (Klbs)	S/O (Klbs)
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
176	0.50	0.62	0.41	0.64	0.40	0.67	0.39	0.69	0.37
236	0.08	0.10	0.07	0.10	0.07	0.11	0.06	0.11	0.06
286	0.93	1.16	0.76	1.20	0.74	1.25	0.71	1.30	0.69
331	0.88	1.09	0.72	1.14	0.70	1.18	0.68	1.23	0.66
420	0.21	0.26	0.17	0.27	0.16	0.28	0.16	0.29	0.16
515	0.08	0.10	0.07	0.10	0.07	0.11	0.07	0.11	0.06
611	0.26	0.32	0.21	0.33	0.20	0.35	0.20	0.36	0.19
705	0.23	0.29	0.19	0.30	0.18	0.31	0.18	0.32	0.17
799	0.23	0.29	0.19	0.30	0.18	0.31	0.17	0.32	0.17
901	0.24	0.30	0.20	0.32	0.19	0.33	0.18	0.34	0.18
1041	0.09	0.11	0.08	0.12	0.07	0.12	0.07	0.13	0.07
1135	3.74	4.75	2.98	4.95	2.87	5.17	2.77	5.39	2.68
1229	3.69	4.66	2.96	4.86	2.85	5.07	2.75	5.29	2.65
1322	2.10	2.63	1.70	2.74	1.64	2.85	1.58	2.97	1.53
1417	3.00	3.76	2.43	3.92	2.34	4.09	2.26	4.27	2.18
1511	3.08	3.84	2.50	4.01	2.41	4.18	2.33	4.36	2.24

Figure 15

3.2.2.9 – Pipe Stretch / Wraps

This shows the total expected pipe stretch and twist the driller will see at a given depth. To return to the main page, click on the 'home' button at the top right hand side of the screen.

PIPE STRETCH & WRAP DATA DATA

	FF 0.25		FF 0.3		FF 0.35		FF 0.4	
MD (FT)	PIPE STRETCH (ins)	PIPE WRAPS (TURNS)	PIPE STRETCH (ins)	PIPE WRAPS (TURNS)	PIPE STRETCH (ins)	PIPE WRAPS (TURNS)	PIPE STRETCH (ins)	PIPE WRAPS (TURNS)
100	0.32	0.00	0.32	0.00	0.32	0.00	0.32	0.00
200	0.56	0.00	0.56	-0.01	0.56	-0.01	0.56	-0.01
300	0.80	0.00	0.80	0.00	0.80	-0.01	0.80	-0.01
400	1.12	0.00	1.12	0.00	1.12	0.00	1.12	-0.01
500	1.51	0.00	1.51	0.00	1.51	0.00	1.51	0.00
600	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00
700	2.38	0.01	2.38	0.01	2.38	0.01	2.38	0.00
800	2.83	0.02	2.83	0.02	2.83	0.01	2.83	0.01
900	3.24	0.03	3.24	0.03	3.24	0.03	3.24	0.03
1000	3.70	0.05	3.70	0.05	3.70	0.05	3.70	0.05
1100	4.12	0.06	4.12	0.06	4.12	0.06	4.12	0.06
1200	4.66	0.09	4.66	0.09	4.66	0.09	4.66	0.09
1300	5.26	0.12	5.26	0.12	5.26	0.12	5.26	0.12
1400	5.89	0.16	5.89	0.16	5.89	0.16	5.89	0.16
1500	6.35	0.19	6.35	0.19	6.35	0.20	6.36	0.20
1600	7.07	0.25	7.07	0.26	7.08	0.27	7.09	0.28
1700	7.81	0.31	7.82	0.33	7.83	0.34	7.84	0.36
1800	8.58	0.38	8.59	0.41	8.60	0.43	8.61	0.46

Figure 16

3.2.3 – Charts

This section of "View Data" allows the T&D plots to be viewed. When any chart is activated, a chart controls window will be displayed in the top left hand corner of the screen.

Figure 17

Most charts will have both buttons however; some will only have the home button. Clicking the home button will return the user to the TAD Calc main page. Clicking on the settings button will bring up the chart adjust window shown below.

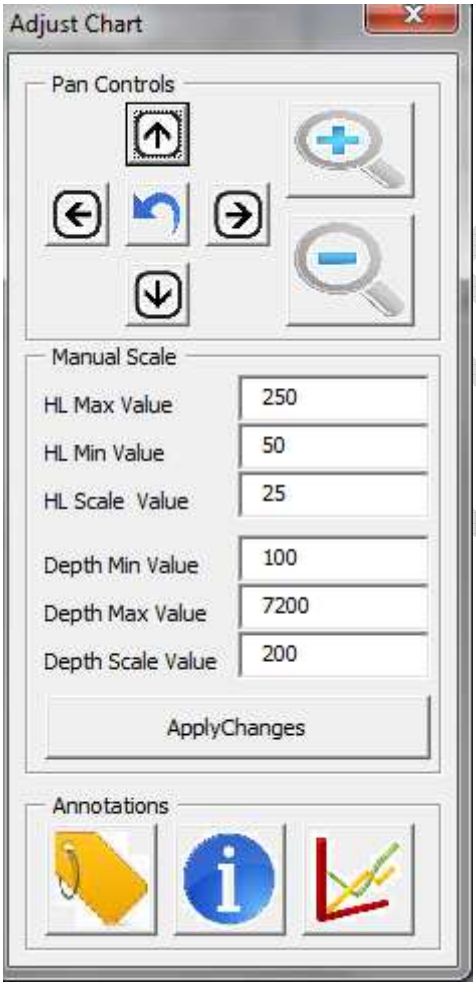


Figure 18

This allows the charts to be panned left, right, up and down by clicking on the arrow buttons. To reset the view, click on the button in the centre of the pan controls. Zooming can be achieved by clicking on the magnifying glass buttons. Manual axis scales can also be set by entering the values in the input boxes shown in Fig. 18. Clicking on the labels icon displays the following dialog box.

Figure 19

Clicking the "Click to Add" button will create a text box at the mouse location on the graph. This function can only be used if the comments are turned on.

Clicking the "On / Off" button toggles the comments entered in the user entered data on or off. To edit the comments, click on the edit button which brings up the following dialog box.

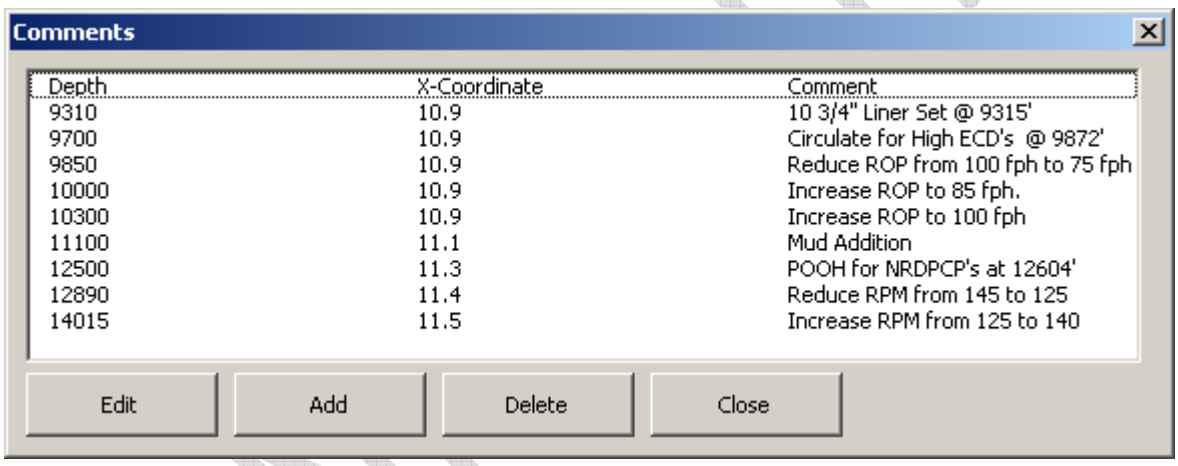


Figure 20

The comments entered in the user entered data section will be displayed and can be edited by clicking the "Edit" button.

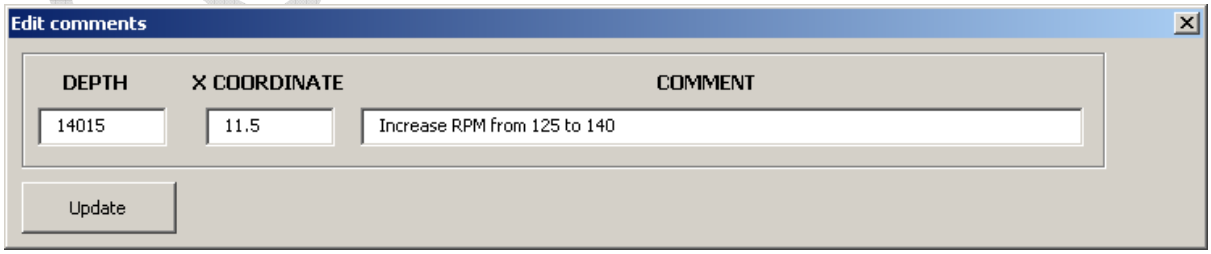


Figure 21

Edit the comment as required and click the update button. The same dialog will appear if the "Add" button in Fig. 20 is clicked.

Click on the “Delete” button to delete a comment and the “Close” button to close the dialog and return to the chart controls.

Clicking on the model information button in Fig. 18 turns on the model data which is described in section 5.1. Clicking on the charts button brings up the following dialog.

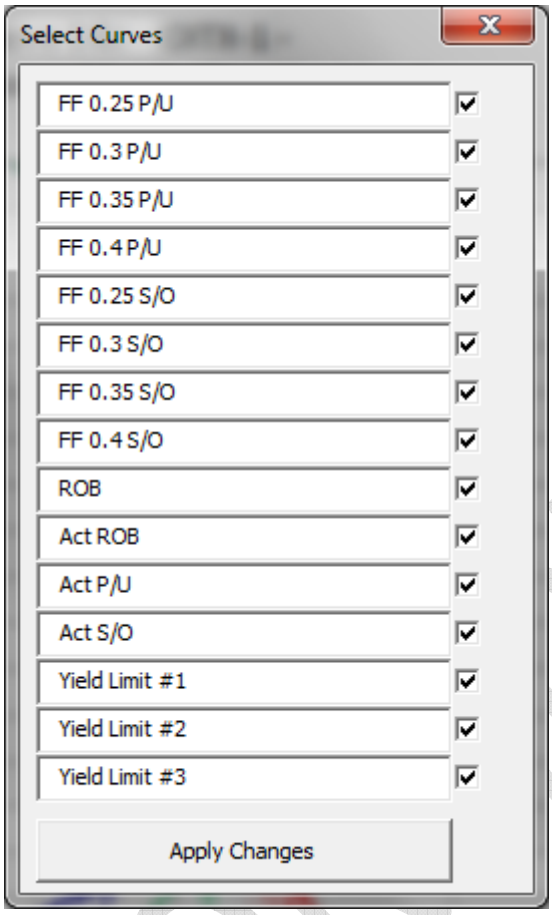


Figure 22

This dialog can be used to turn curves on and off by clicking on the check boxes to the right hand side of the curve.

3.2.3.1 – Hookloads

Clicking on the “Hookloads” button brings up the following window.

Figure 23

3.2.3.1.1 – Hookloads Driller's View

This show the driller's hookloads chart. Calculated values for multiple friction factors are displayed along with actual drilling data from the real time data page. Pipe yield limits can also be displayed.

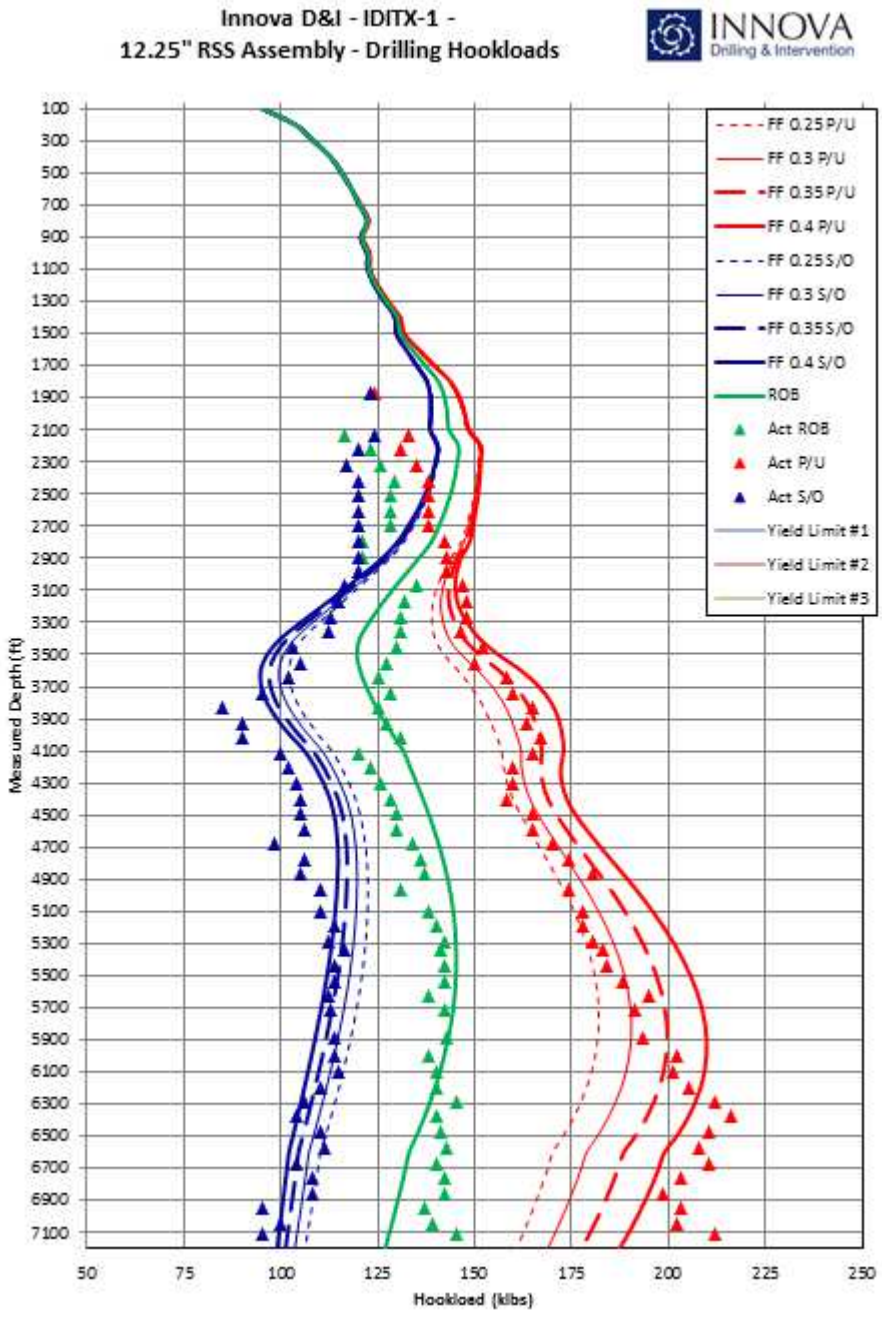


Figure 24

3.2.3.1.2 – Tension Snapshot

This chart shows the off bottom tensions throughout the drill string. It also shows the helical and sinusoidal buckling limits. The surface value includes the block weight.

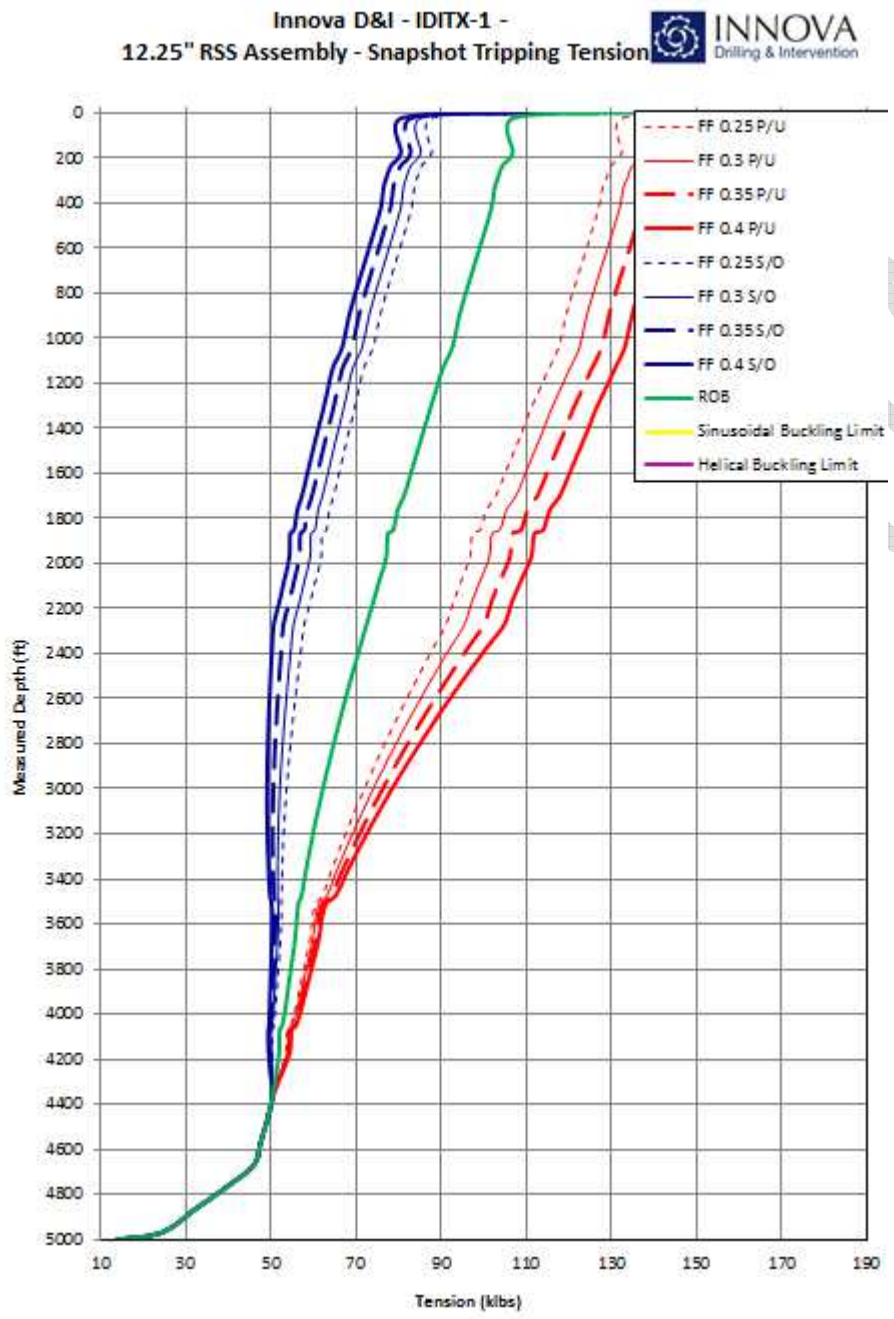


Figure 25

3.2.3.1.3 – Tension On Bottom Snapshot

This chart shows the on bottom tensions throughout the drill string. It also shows the helical and sinusoidal buckling limits. The surface value includes the block weight.

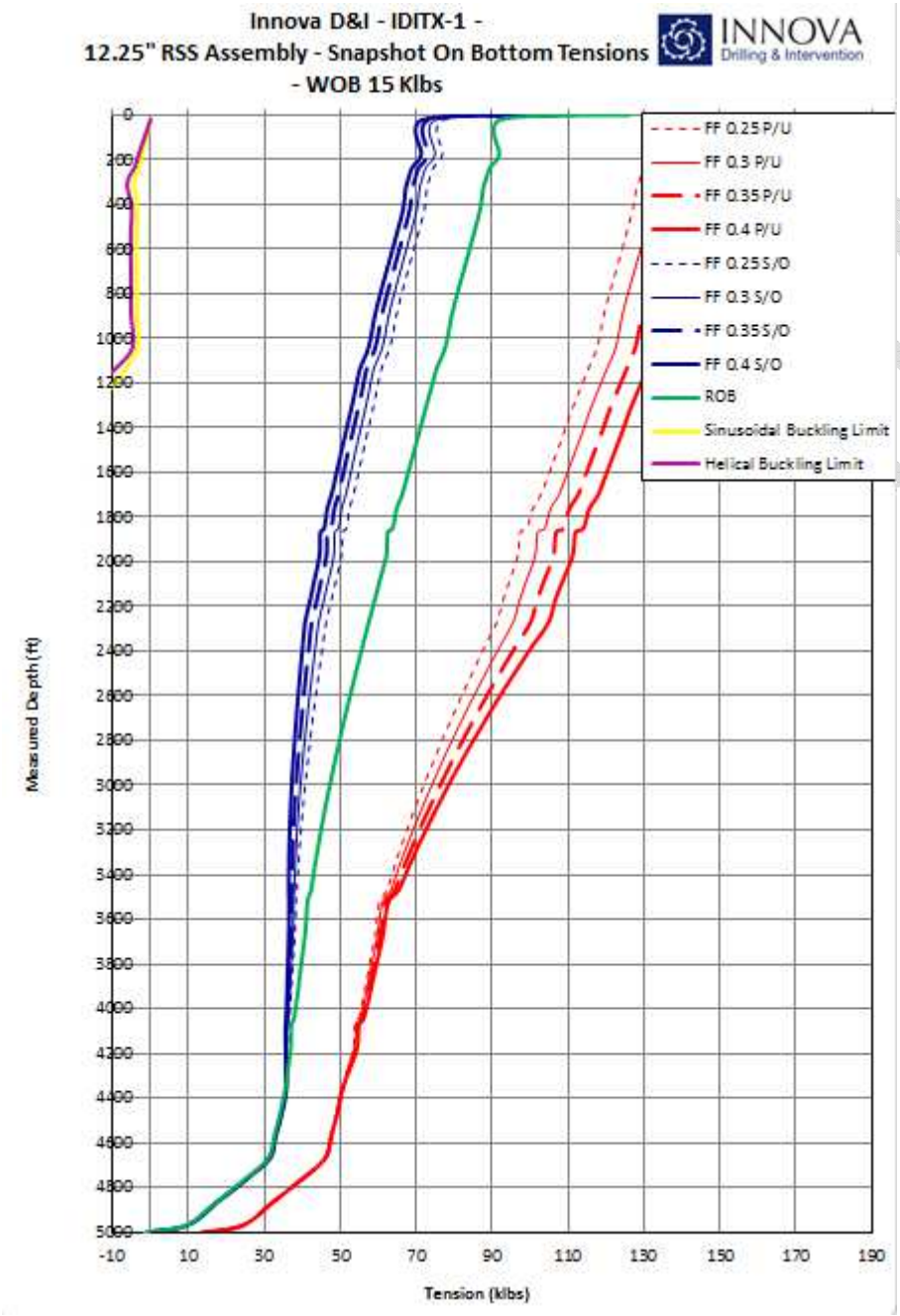


Figure 26

3.2.3.1.4 – Reaming Hookloads

This chart shows the hookloads whilst reaming up and down

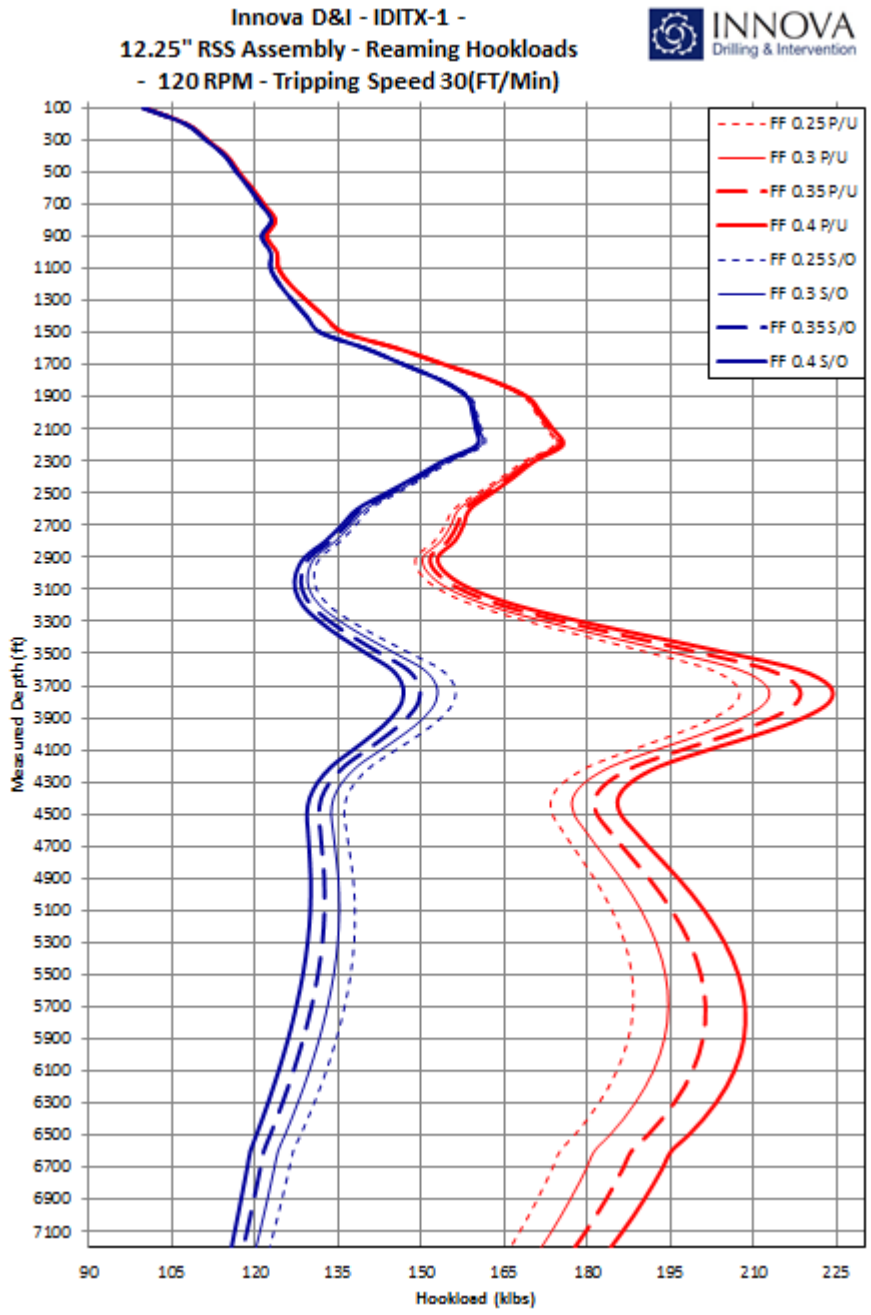


Figure 27

3.2.3.2 – Torques

Clicking on the “Torques” button brings up the following window.

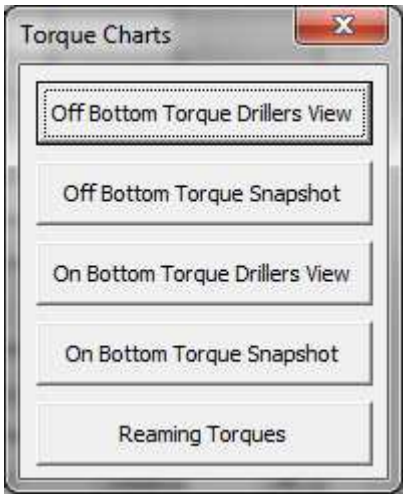


Figure 28

3.2.3.2.1 – Off Bottom Torque Driller's View

This chart displays the off bottom torques as the driller would see it.

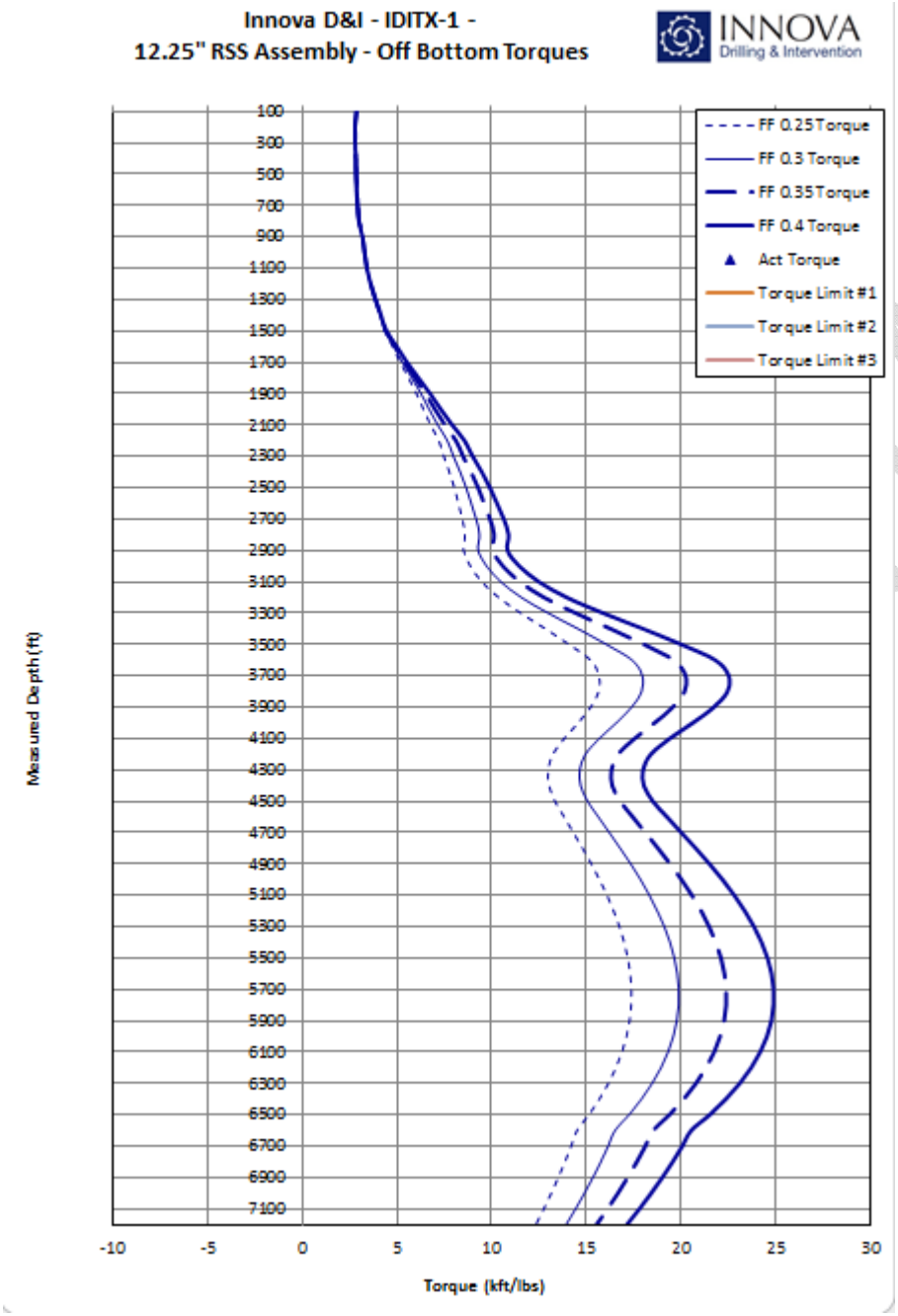


Figure 29

3.2.3.2.2 – Off Bottom Torque Snapshot

This chart displays the elemental off bottom torque at a specific depth.

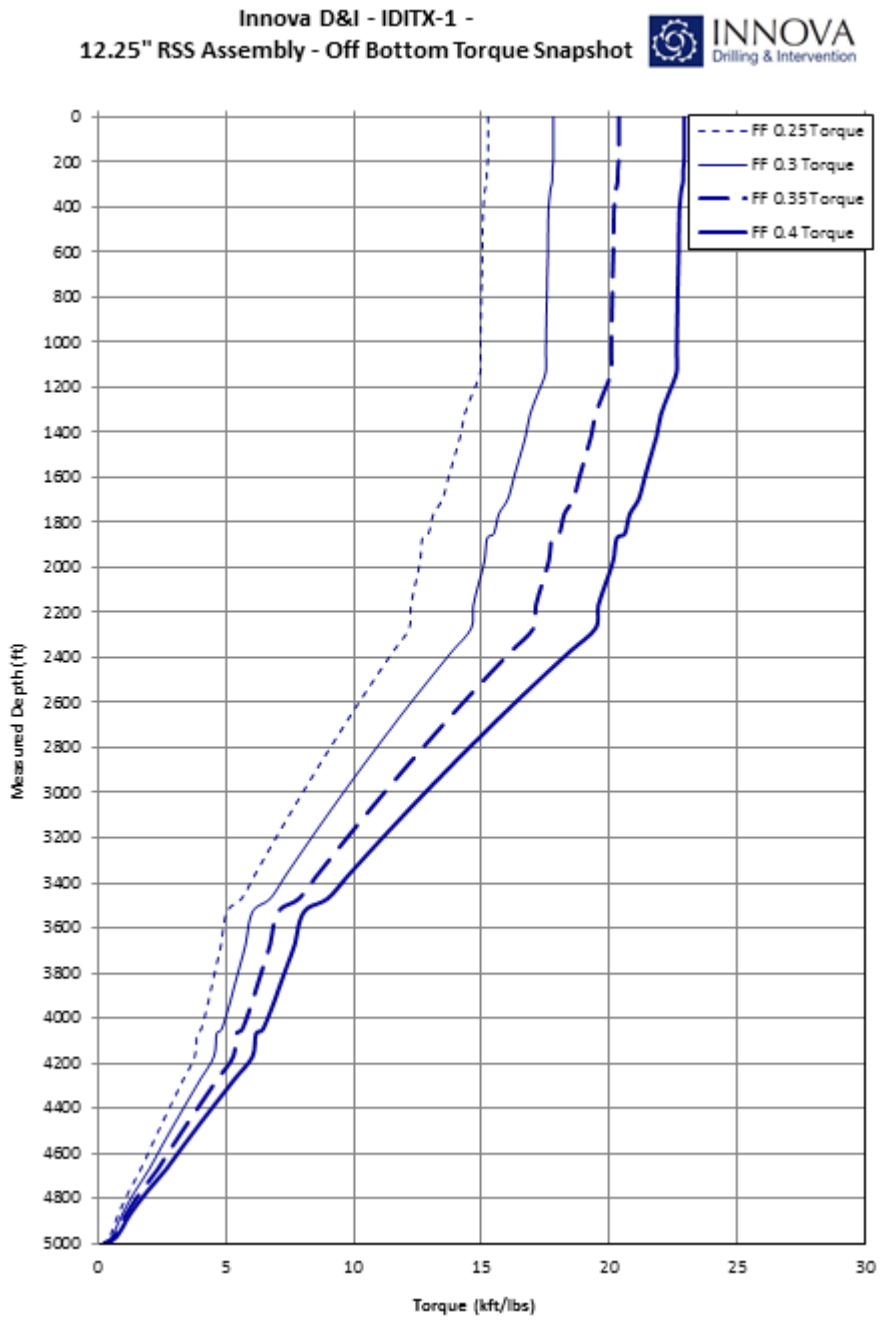


Figure 30

3.2.3.2.3 – On Bottom Torque Driller's View

This chart displays the on bottom torques as the driller would see it.

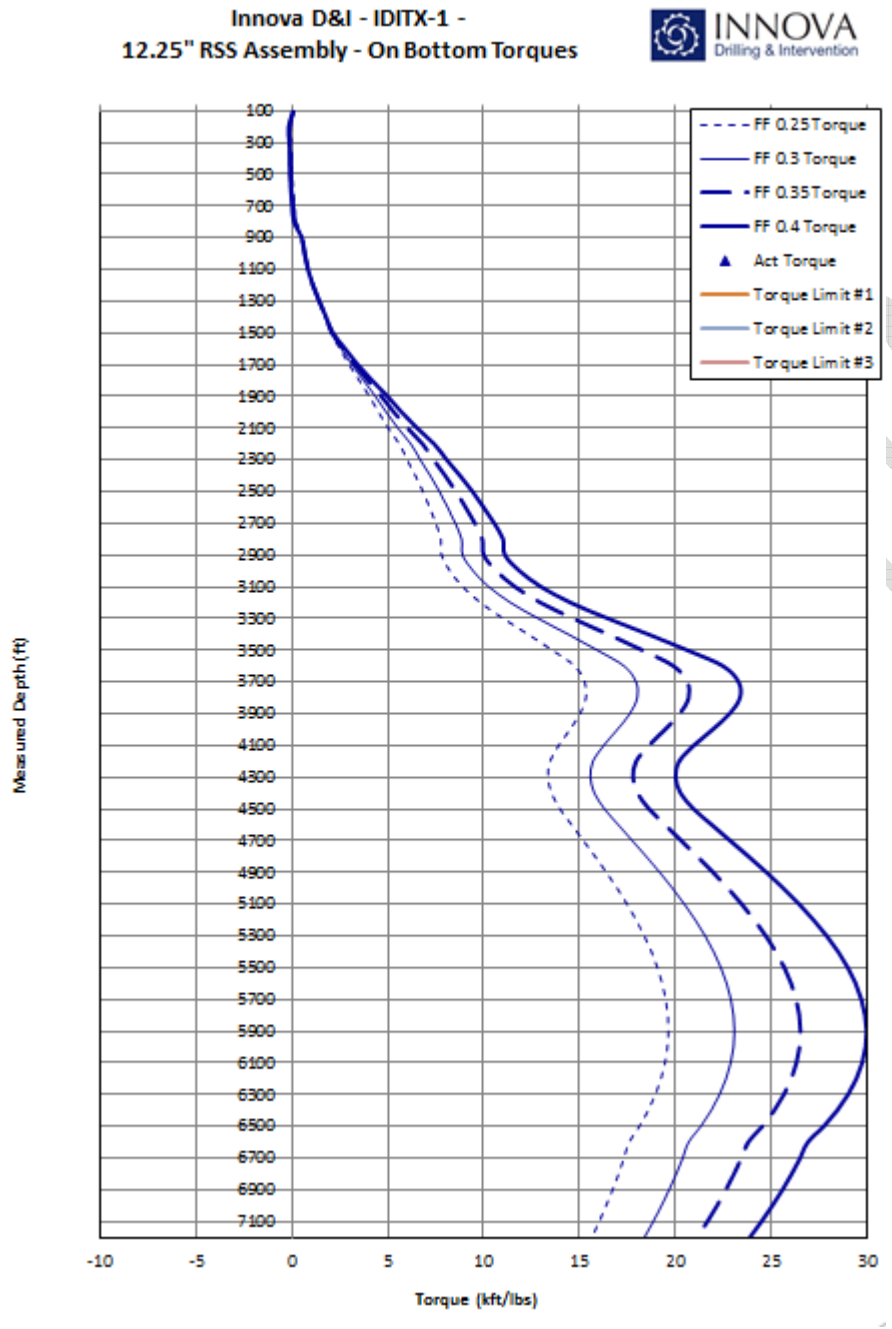


Figure 31

3.2.3.2.4 – On Bottom Torque Snapshot

This chart displays the elemental on bottom torque at a specific depth.

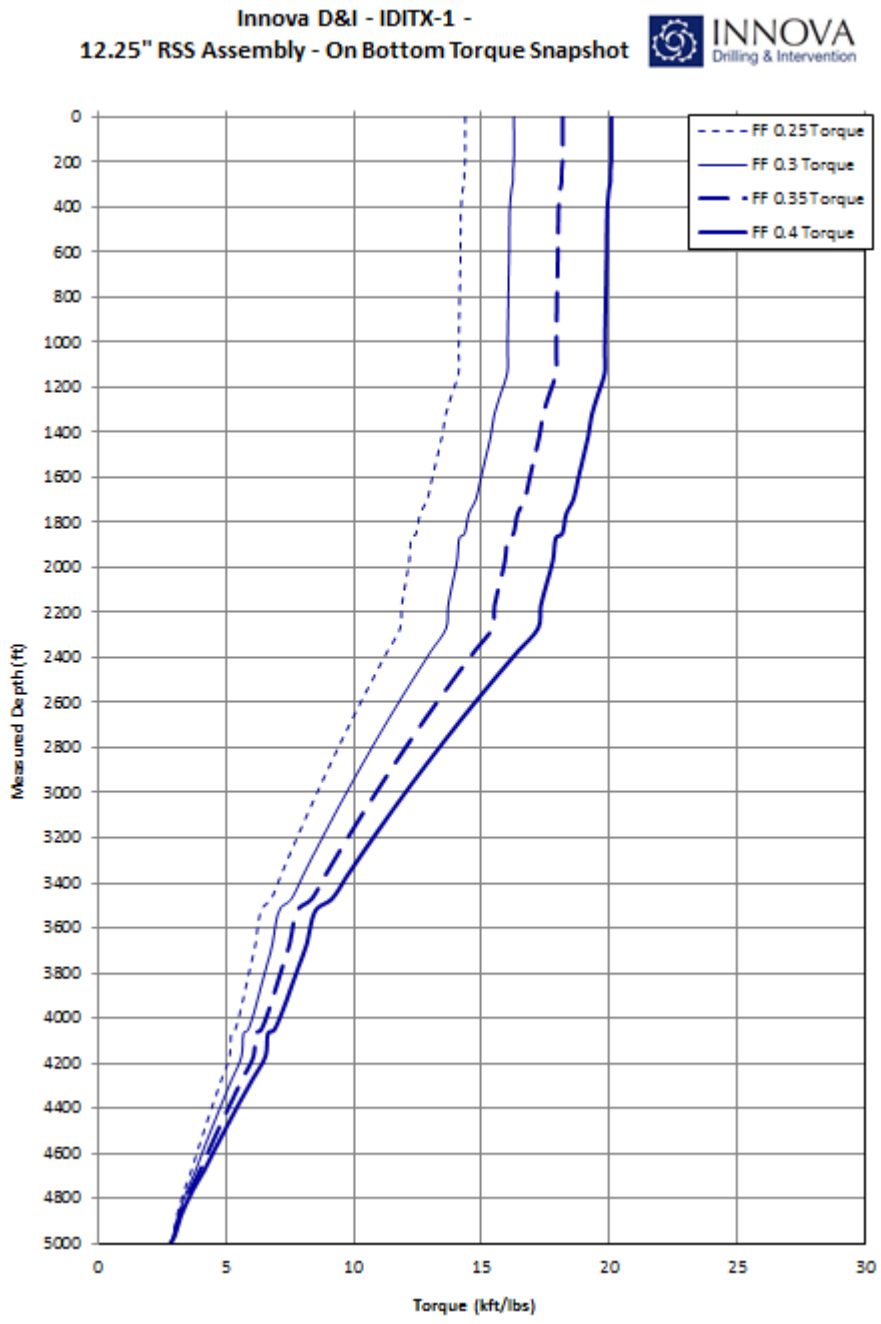


Figure 32

3.2.3.2.5 - Reaming Torques

This chart displays torques while reaming as the driller would view them.

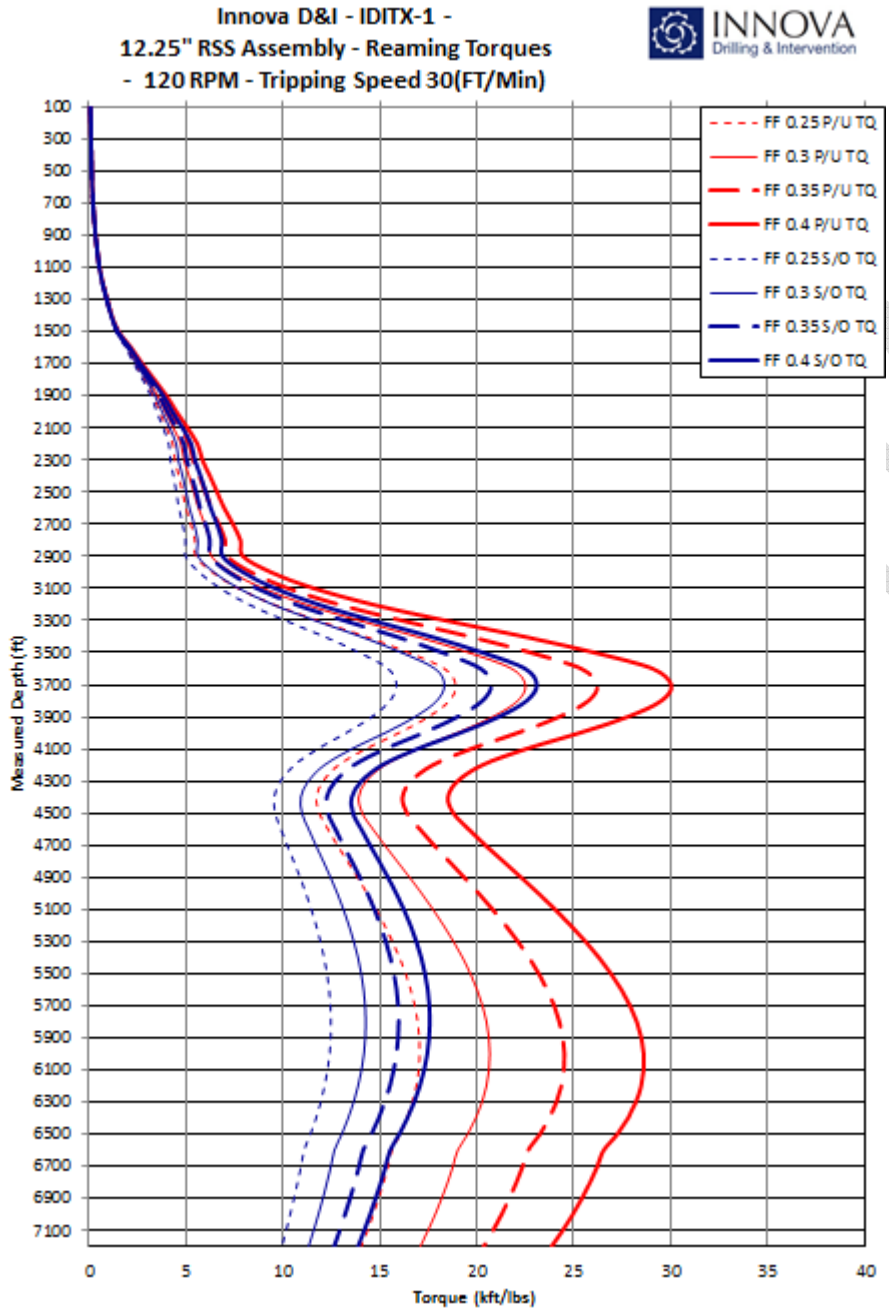


Figure 33

3.2.3.3 – Side Forces

This chart displays the side forces (normal contact) at a given depth

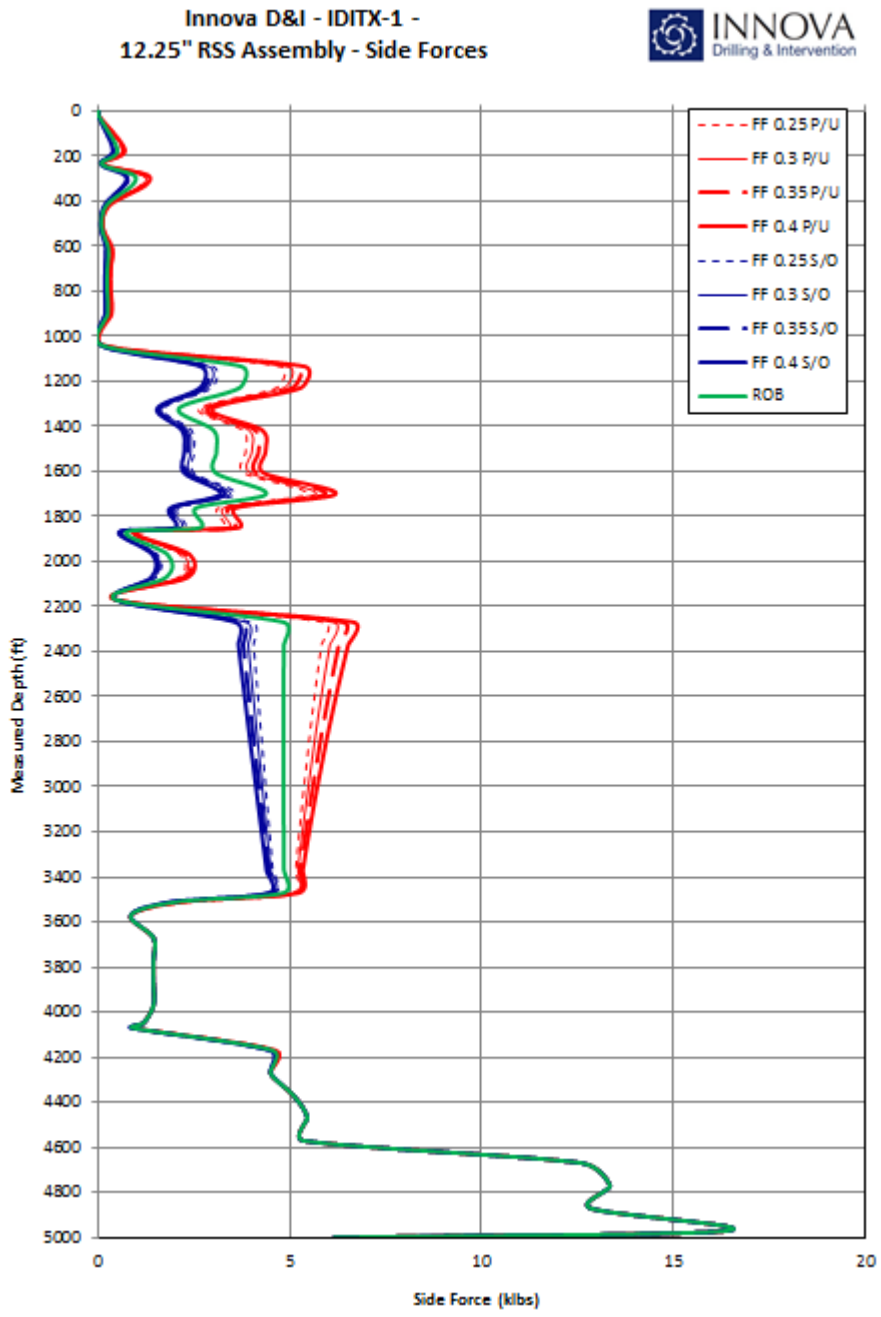


Figure 34

3.2.3.4 – Pipe Stretch

This chart shows the pipe stretch of the drill string

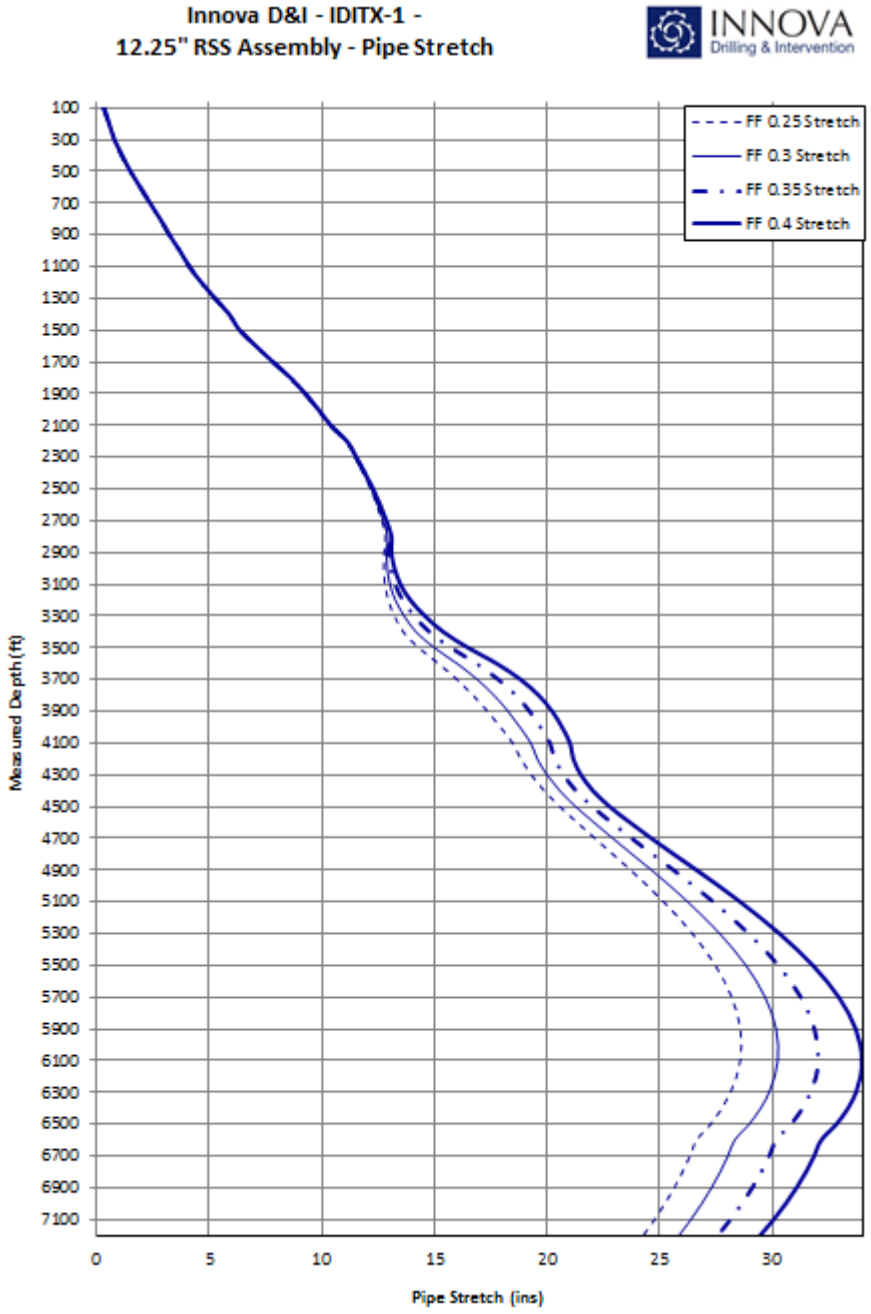


Figure 35

3.2.3.5 – Pipe Wraps

This chart shows the expected number of wraps (twist) at a given depth

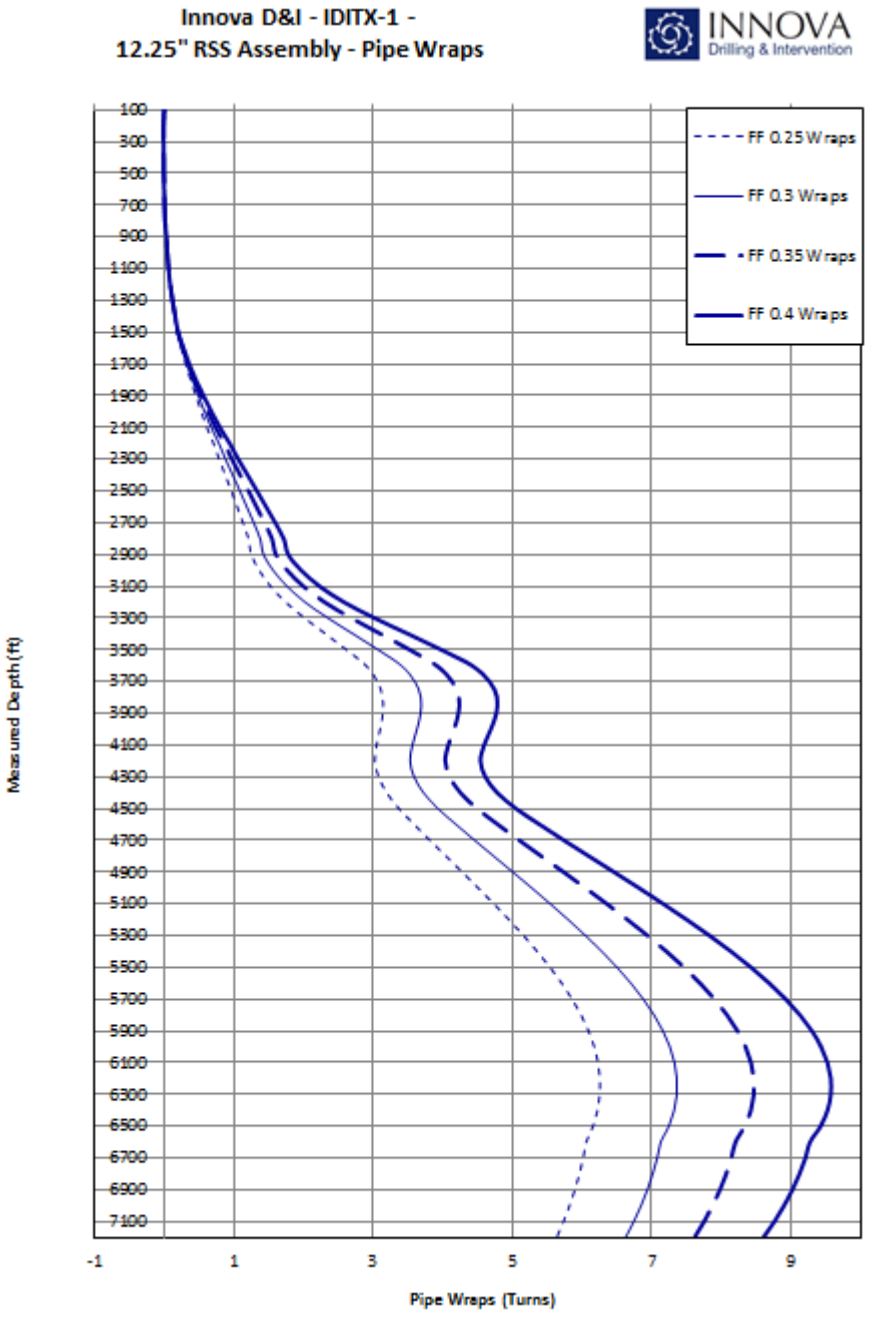


Figure 36

3.2.3.6 – Apparent WOB

This chart is not currently available.

3.2.3.7 – Apparent Overpull

This chart is not currently available.

3.2.3.8 – Plan View

This chart shows the well plan view. Both actual surveys and the well plan are displayed.

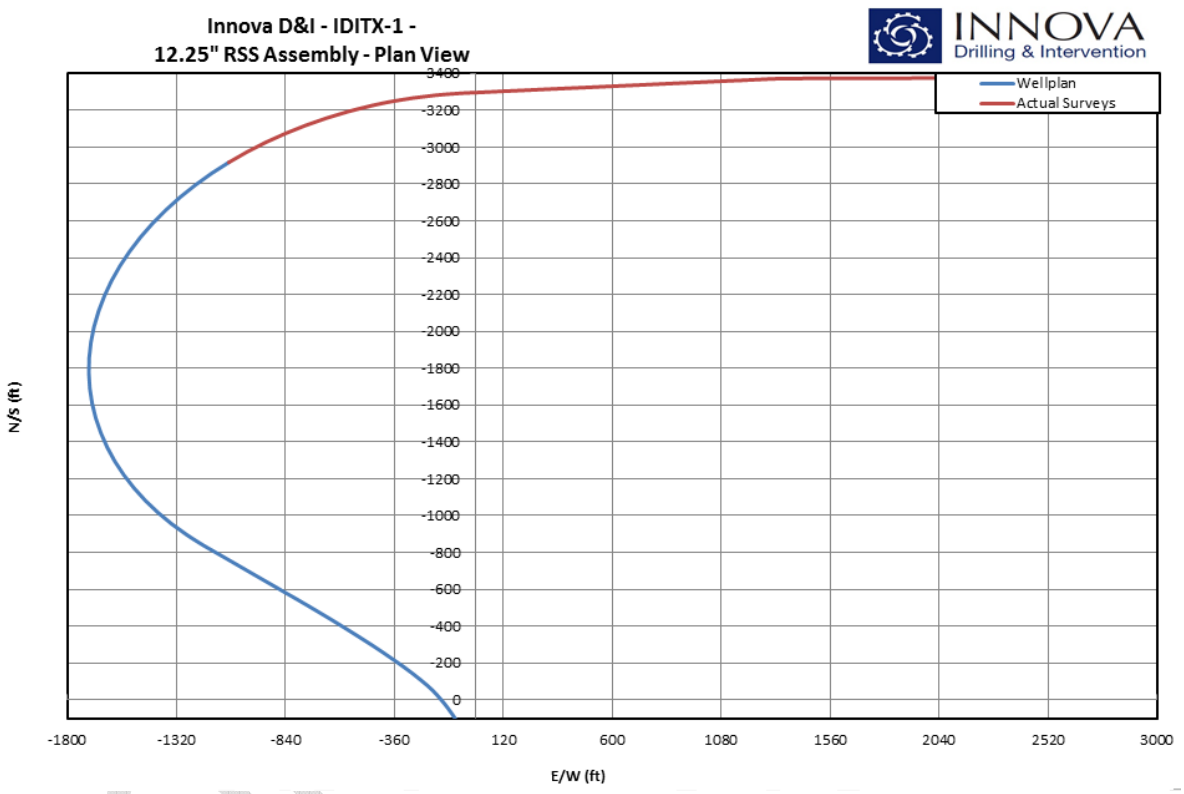


Figure 37

3.2.3.9 – Section View

This chart shows the well section view. Both actual surveys and the well plan are displayed.

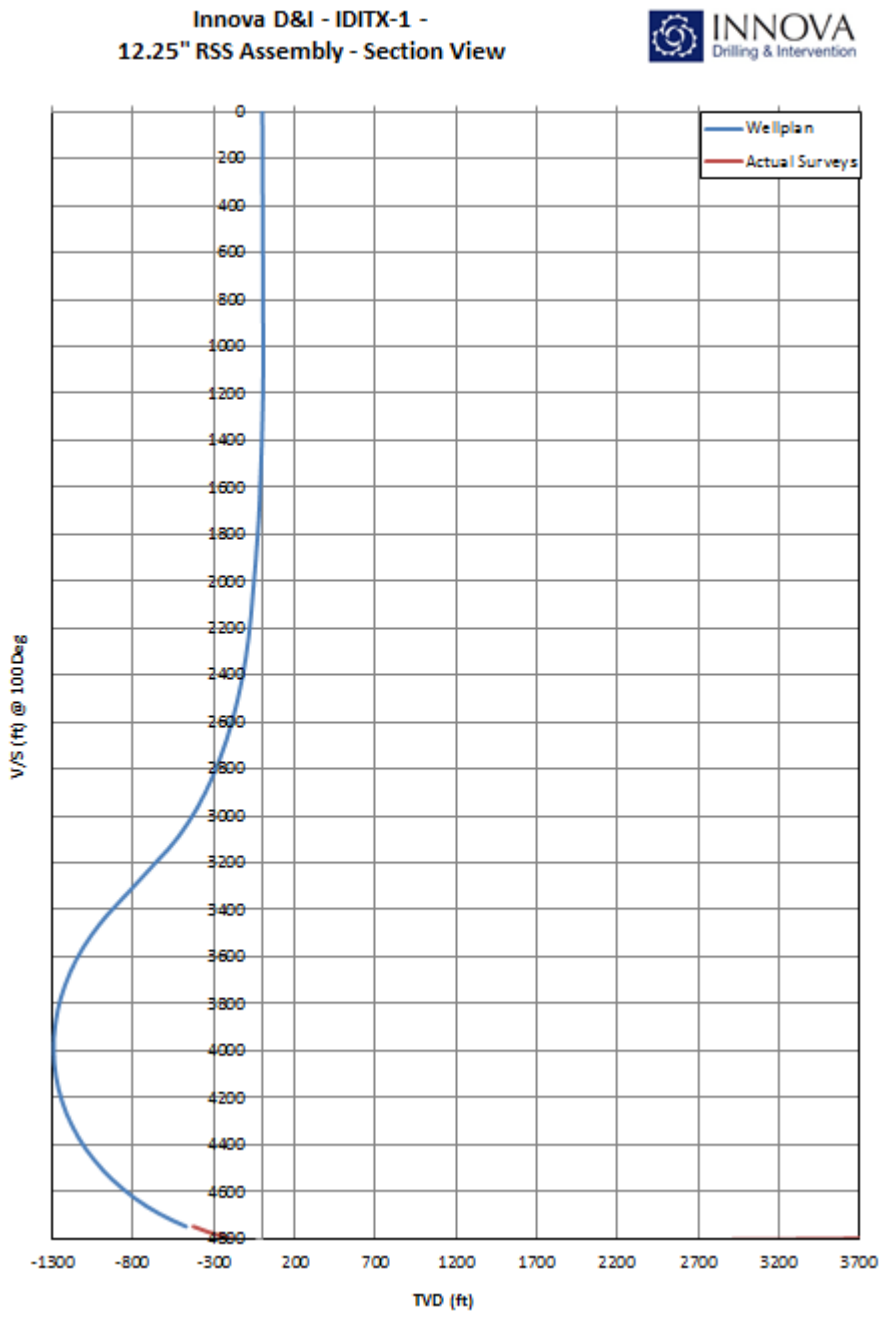
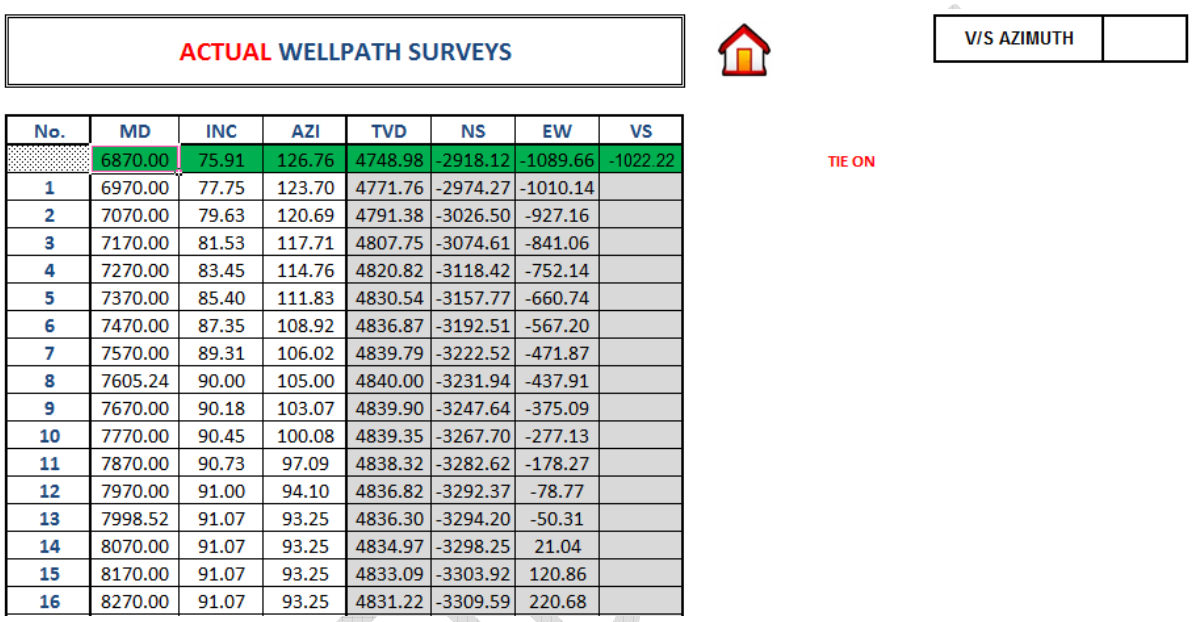


Figure 38

3.2.4 – Surveys

Details for the well plan and actual surveys can be entered in this section. Surveys must be entered in order to perform a calculation. Surveys must cover the entire calculation range. It is advised to enter a well plan to cover the entire well even if these surveys are just planned values. As surveys are taken whilst drilling, enter them in to the actual surveys page. Once the model is regenerated the actual surveys will be inserted in to the well plan.

3.2.4.1 – Actual Surveys



ACTUAL WELLPATH SURVEYS

V/S AZIMUTH

TIE ON

No.	MD	INC	AZI	TVD	NS	EW	VS
	6870.00	75.91	126.76	4748.98	-2918.12	-1089.66	-1022 22
1	6970.00	77.75	123.70	4771.76	-2974.27	-1010.14	
2	7070.00	79.63	120.69	4791.38	-3026.50	-927.16	
3	7170.00	81.53	117.71	4807.75	-3074.61	-841.06	
4	7270.00	83.45	114.76	4820.82	-3118.42	-752.14	
5	7370.00	85.40	111.83	4830.54	-3157.77	-660.74	
6	7470.00	87.35	108.92	4836.87	-3192.51	-567.20	
7	7570.00	89.31	106.02	4839.79	-3222.52	-471.87	
8	7605.24	90.00	105.00	4840.00	-3231.94	-437.91	
9	7670.00	90.18	103.07	4839.90	-3247.64	-375.09	
10	7770.00	90.45	100.08	4839.35	-3267.70	-277.13	
11	7870.00	90.73	97.09	4838.32	-3282.62	-178.27	
12	7970.00	91.00	94.10	4836.82	-3292.37	-78.77	
13	7998.52	91.07	93.25	4836.30	-3294.20	-50.31	
14	8070.00	91.07	93.25	4834.97	-3298.25	21.04	
15	8170.00	91.07	93.25	4833.09	-3303.92	120.86	
16	8270.00	91.07	93.25	4831.22	-3309.59	220.68	

Figure 39

Survey data can be entered in this section. When new surveys are entered, the data must be regenerated in order for the new data to take effect. Enter a vertical section azimuth in order to view the section plots. It is advised the vertical section azimuth be the same for the well plan and the actual surveys. To return to the main page, click on the home icon.

3.2.4.2 – Well plan

WELLPLAN SURVEYS

V/S AZIMUTH	

No.	MD	INC	AZI	TVD	NS	EW	VS
	0.00	0.00	106.52	0.00	154.94	-67.64	0.00
1	22.00	0.00	106.52	22.00	154.94	-67.64	
2	176.00	0.27	106.52	176.00	154.84	-67.29	
3	236.00	0.23	103.12	236.00	154.77	-67.04	
4	286.00	0.74	93.72	286.00	154.73	-66.62	
5	331.00	0.29	69.40	331.00	154.75	-66.22	
6	420.00	0.40	65.19	419.99	154.96	-65.73	
7	515.00	0.37	60.87	514.99	155.24	-65.16	
8	611.00	0.41	81.52	610.99	155.45	-64.55	
9	705.00	0.33	65.23	704.99	155.61	-63.97	
10	799.00	0.41	81.88	798.99	155.77	-63.39	
11	901.00	0.33	63.37	900.98	155.95	-62.77	
12	1041.00	0.30	55.88	1040.98	156.34	-62.11	
13	1135.00	2.11	212.91	1134.96	155.02	-62.84	
14	1229.00	4.47	212.01	1228.80	150.47	-65.72	
15	1322.00	5.77	213.71	1321.43	143.50	-70.24	
16	1417.00	7.58	208.23	1415.78	134.01	-75.85	

TIE ON

Figure 40

Well plan data can be entered in this section. When new surveys are entered, the data must be regenerated in order for the new data to take effect. Enter a vertical section azimuth in order to view the section plots. It is advised the vertical section azimuth be the same for the well plan and the actual surveys. To return to the main page, click on the home icon.

3.2.5 – Data

3.2.5.1 – Model Info

Figure 41

Clicking on the “Model Information” allows the user to add a text box which can be displayed on the Driller’s View hookload, on / off bottom torques chart. This button allows the user to enter the text

data to be displayed. The data is typed in to the text box shown in Fig. 29. To enter a new line of data, press “SHIFT + ENTER” together.

Pipe yield and torque limit data can be entered in the lower section of the dialog. Enter the description of the yield or torque limit and the value. The limits can be displayed on the hookloads and torque charts.

To add the data click on the “Add Data” button.

3.2.5.2 – Real Time Data

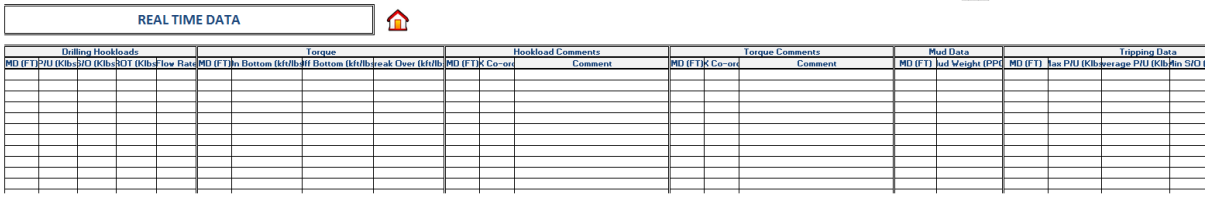


Figure 42

The user entered data section allows the user to enter data obtained from real world sources by hand. Data that can be entered include: P/U, S/O, ROB, Flow rate, break over torque, on bottom torque and off bottom torque. Each item of data requires a corresponding measured depth so it can be graphed.

The mud weight can also be entered here and the buoyancy factors of the model will be adjusted accordingly at the depths specified.

If you wish to add comments to be displayed on the graphs, enter them in the comments section. The comments will be displayed next to the graph at the measured depth specified. The X Co-ord box determines the x-axis location of the comment.

3.2.6 – String Data

3.2.6.1 – Friction Reduction Devices

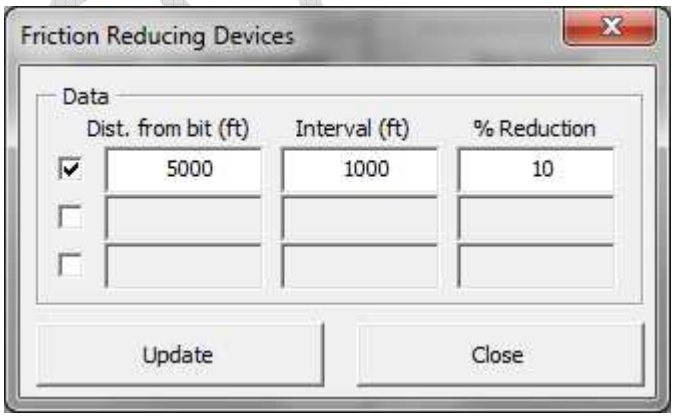


Figure 43

The dialog shown above allows friction reduction devices to be added to the string. Click the check box to activate a section. Enter the distance from the bit (the measured depth) when the devices will first be added and the length of the interval and the reduction in friction they will provide.

3.2.6.2 – Pipe Fill Data

This feature is not currently available.

Appendix A – Enabling Macros

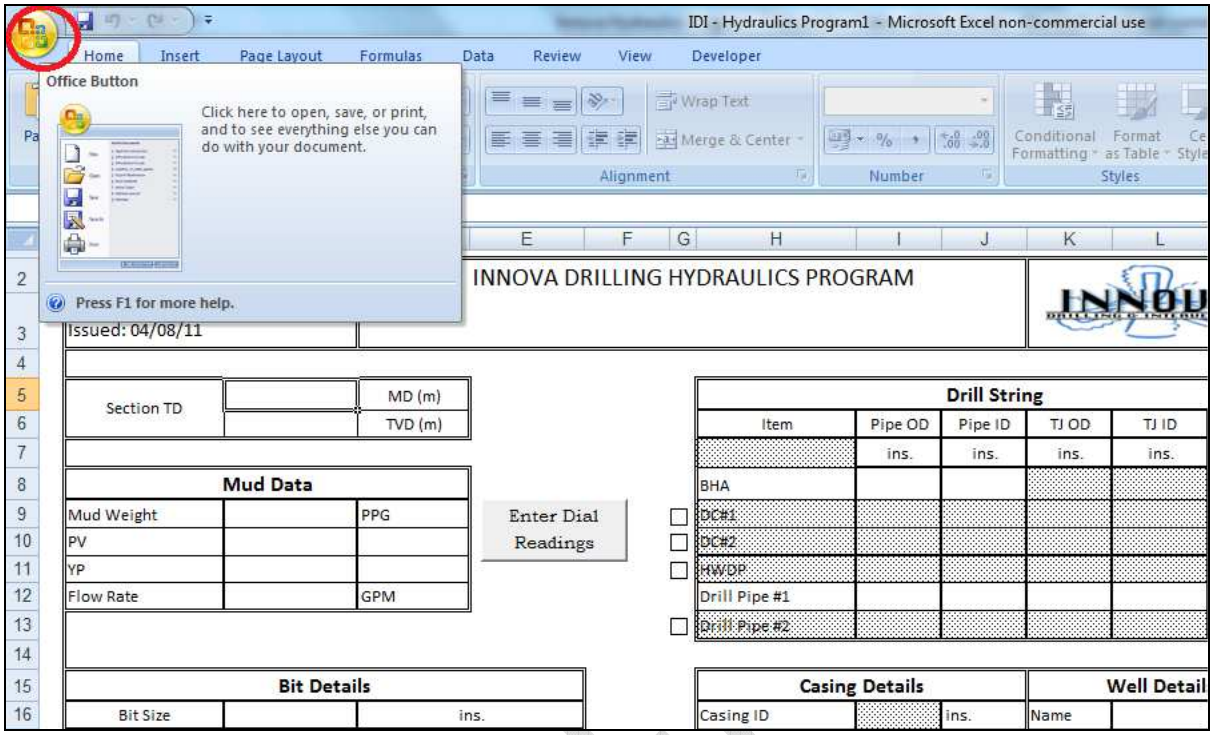


Figure 44

1. Click on the button circled above (Excel 2007) or the file tab in Excel 2010

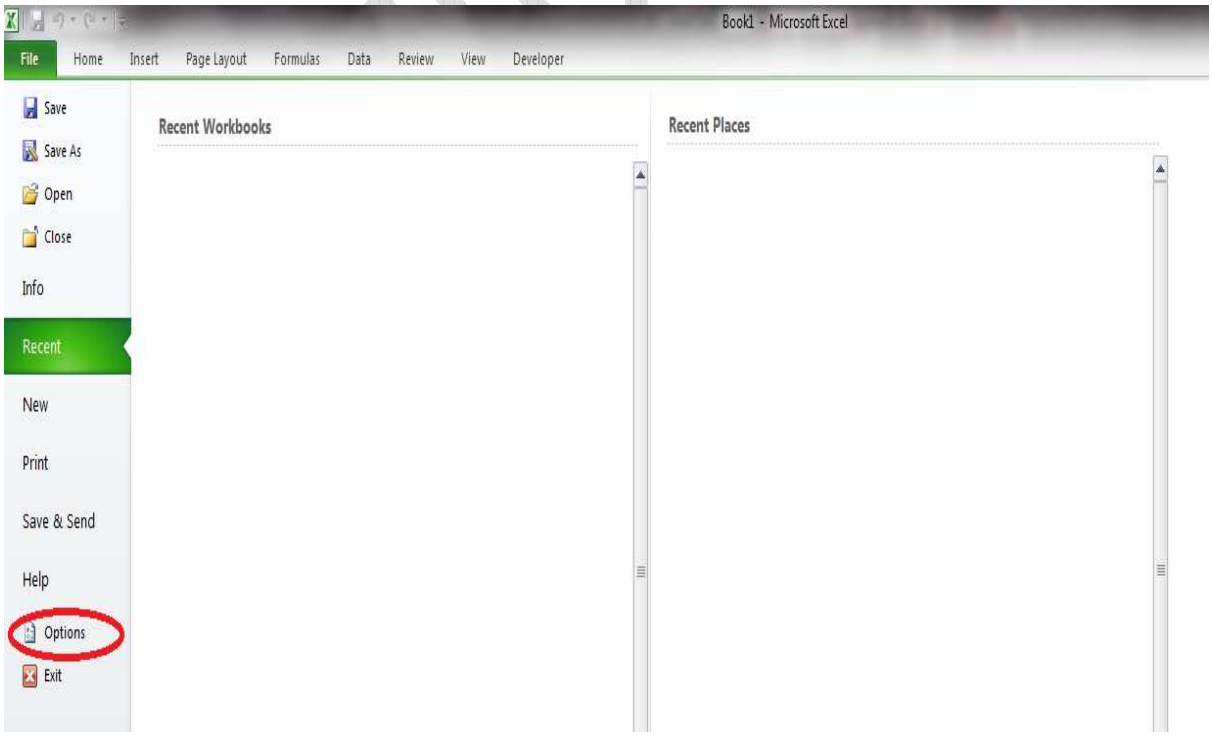


Figure 45

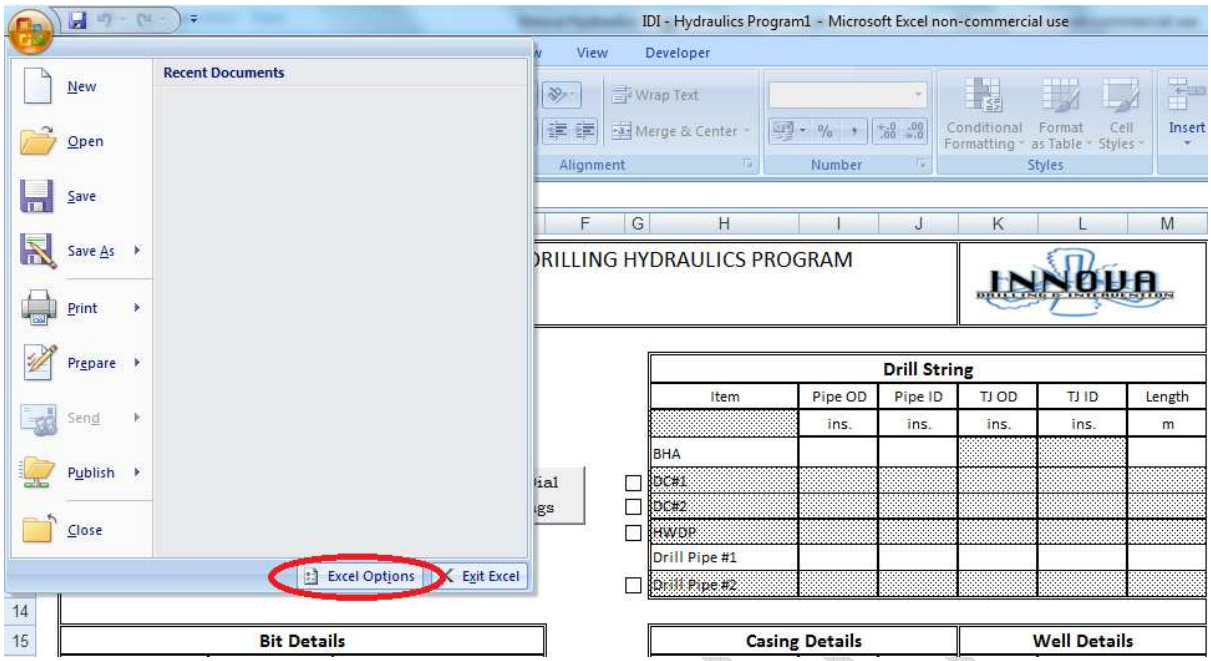


Figure 46

2. Click on the Excel options button in the menu that appears (Fig. 45 Excel 2010, Fig. 46 Excel 2007)

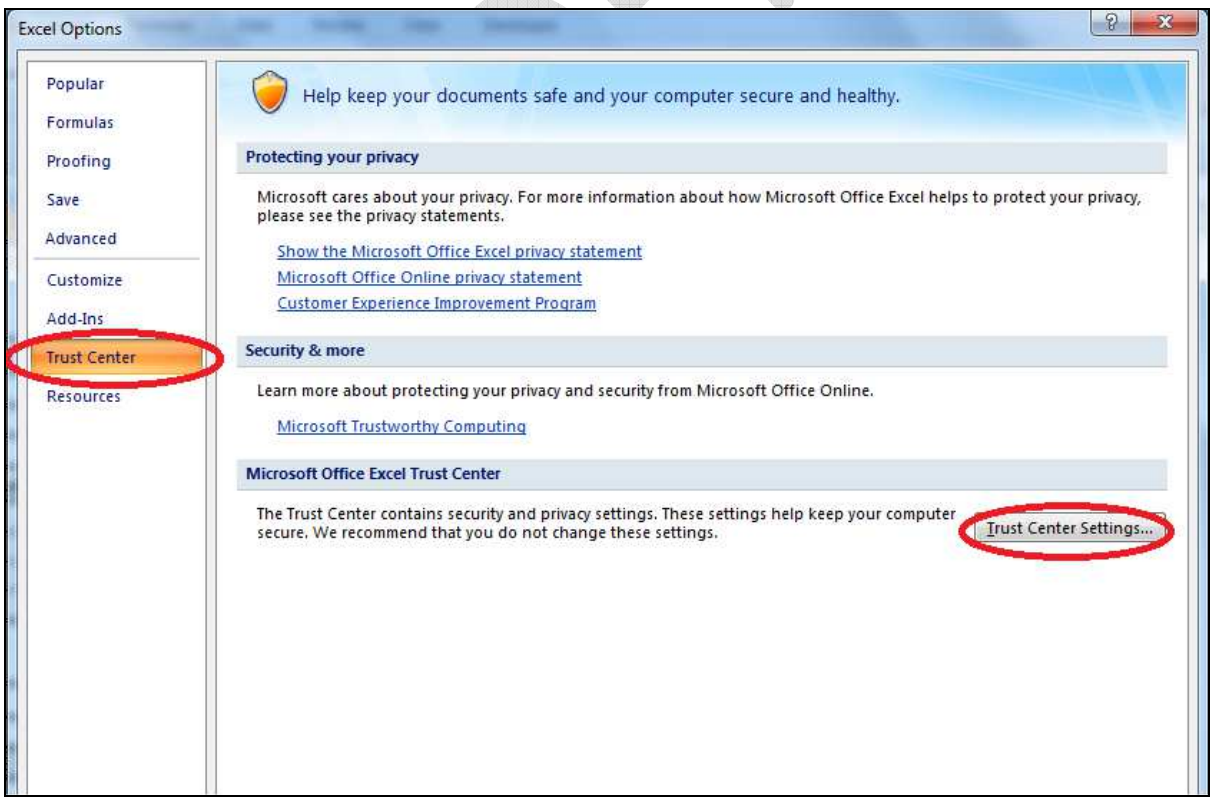


Figure 47

3. Click on the trust center option on the sidebar and then click on the trust center settings button on the screen that appears

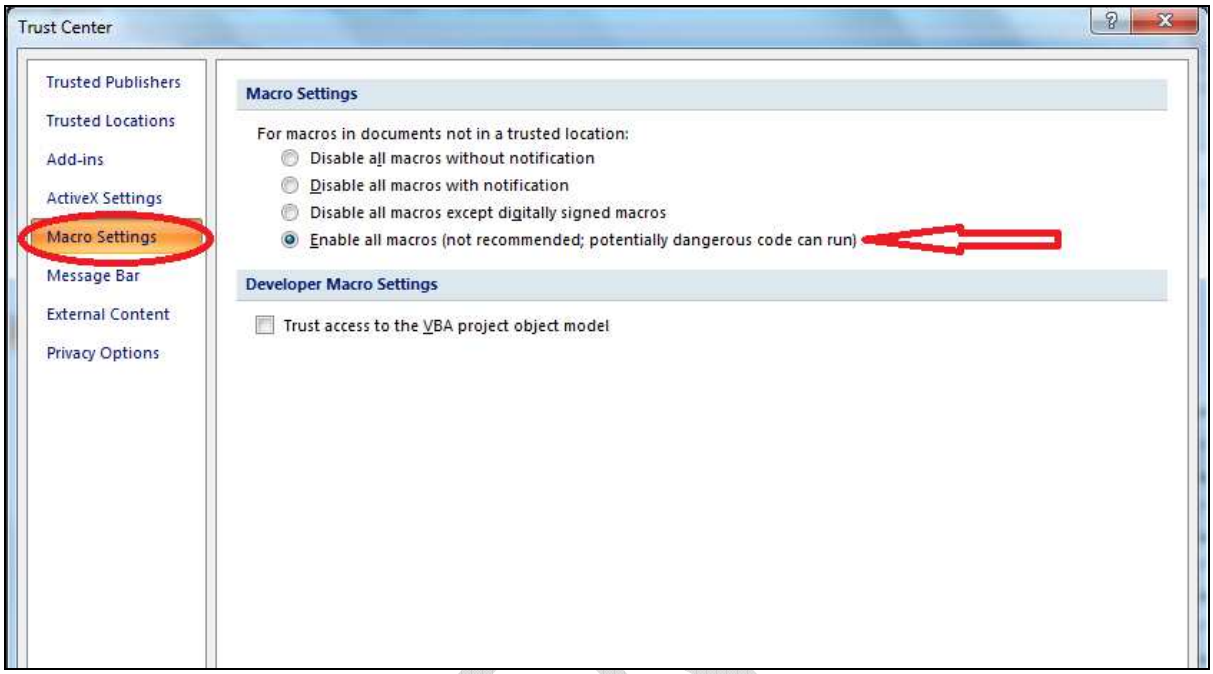


Figure 48

4. Click on the macro settings tab in the side bar and then highlight the enable macros option radio button

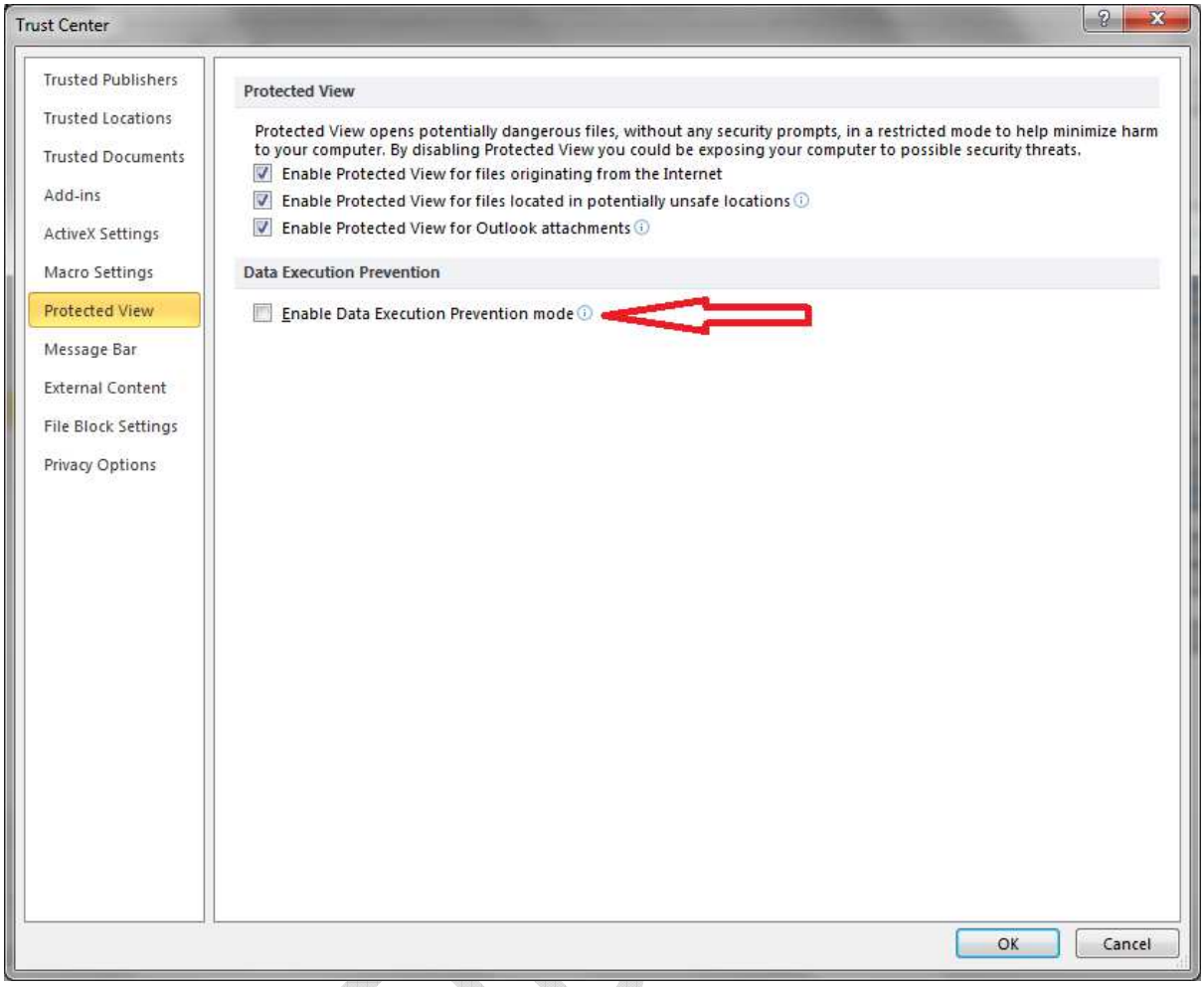


Figure 49

5. Click on the protected view tab on the left hand menu and ensure that the "Enable Data Execution Prevention Mode" is **NOT** checked.

Appendix B – Nomenclature

MD: Measured Depth

TVD: True Vertical Depth

INC: Inclination

AZI: Azimuth

TD: Total Depth

OD: Outside Diameter

ID: Inside Diameter

TJ: Tool Joint

HWDP: Heavy Weight Drill Pipe

DP: Drill Pipe

OH: Open Hole

CH: Cased Hole

BHP: Bottom Hole Pressure

P/U: Pick Up

S/O: Slack Off

ROB: Rotating On Bottom

FF: Friction Factor

Appendix C – Registering Software

To register the software click on the "Register – IDI – Flow Plan" tab in the Excel ribbon at the top of the screen as shown in Fig. 19 below.

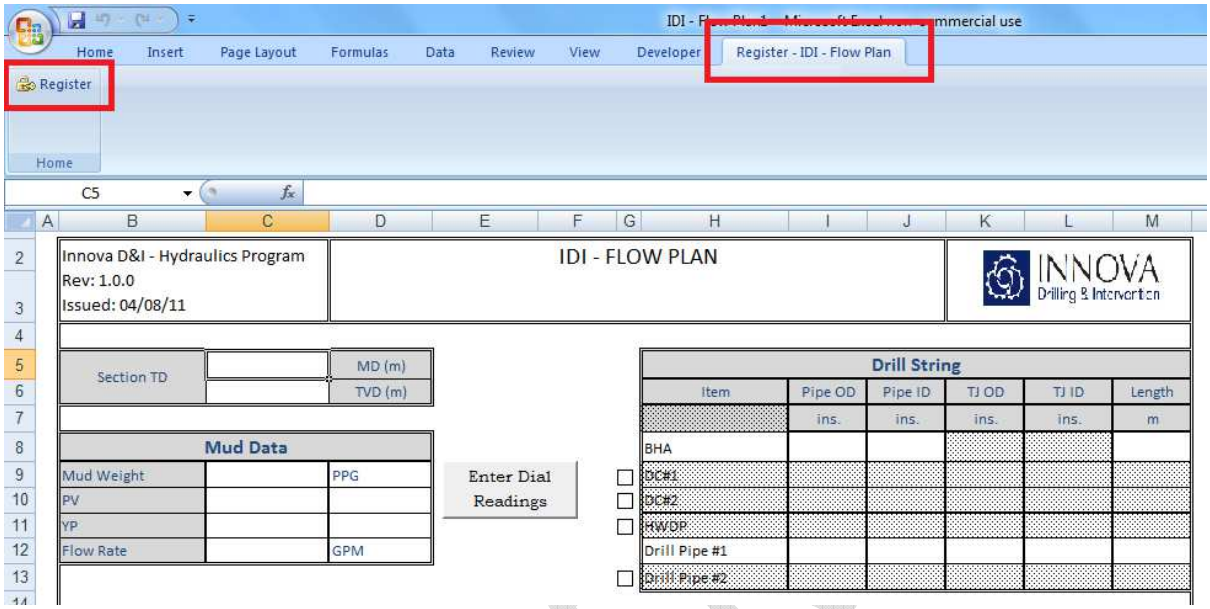


Figure 50

Click on the register button circled in red to bring up the dialog shown in Fig. 50.

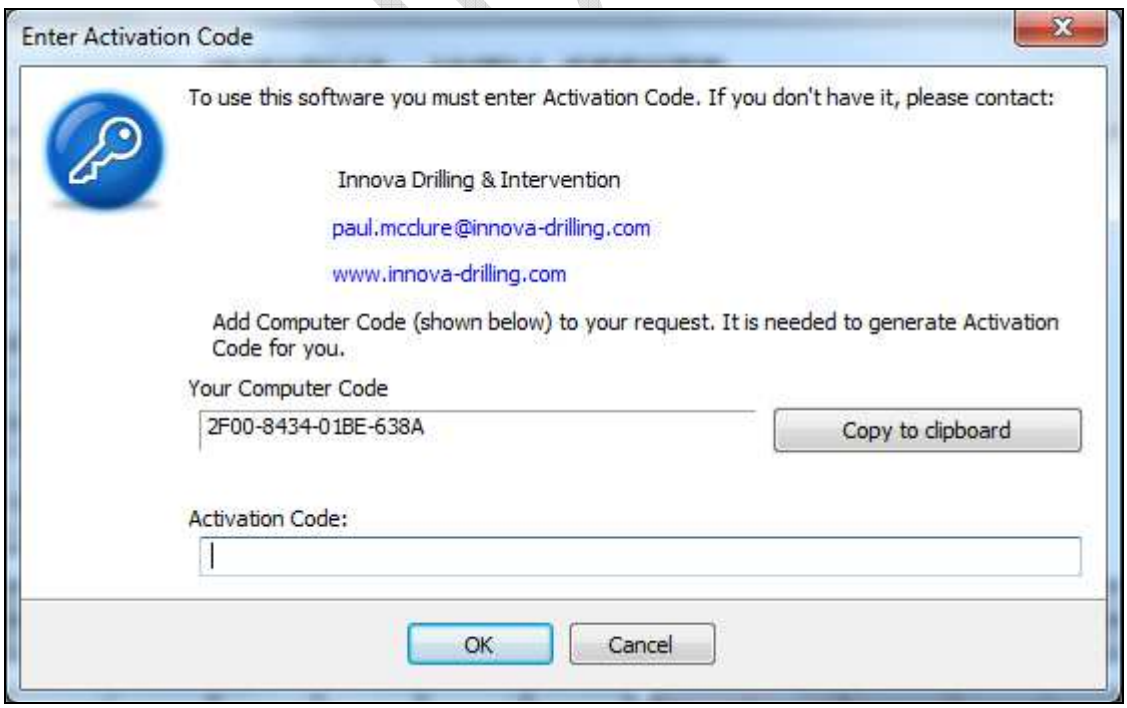


Figure 51

Send the computer code to Innova Drilling & Intervention, either by e-mail or via the Innova website, www.innova-drilling.com. You will then receive an activation code which should be copied in to the activation code box. Click the “OK” button to activate your software.